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BOARD OF AGRICULTURE

Vol. XX. No 1.

APRIL, 1913.

AGRICULTURAL EDUCATION IN PRUSSIA.

In view of the steps which are now being taken to encourage the establishment of Farm Schools and Farm Institutes in this country, a short account of agricultural education in Prussia and of the facilities that are provided at the present time for educating the sons of Prussian farmers may be opportune.

The development and present position in Prussia of what we in this country are beginning to call Farm Institute work is not a little complicated by its connection on the one hand with continuation schools, and on the other with secondary schools.

Lower agricultural education began at a much later date than was the case with education of University rank. Its beginnings may be traced in the middle of last century in the foundation, both by private individuals and public bodies, of agricultural schools in which stress was laid on the practical side of the education given. It is a curious fact, however, that, with the progress of time, these schools have become more and more theoretical, and have given rise to Secondary Schools with an agricultural bias where the education is almost entirely of a theoretical nature, to Lower Agricultural Schools (*Ackerbauschulen*), where the education is largely theoretical, and to Winter Schools (*Winterschulen*), where only theoretical education is given. This tendency is no doubt largely due to the fact that a practical man who becomes a teacher finds it difficult to resist the temptation gradually to stereotype the subjects which he is called upon to teach. It has been overcome in some measure as regards Prussian agricultural

education by the successful development of the itinerant method of teaching, which not only benefits the agricultural teachers, who are withdrawn from their stationary activities and revive their practical experience during their wanderings, but also the students, who, besides getting the benefit from the new experiences of their teachers, are also encouraged to make similar journeys about the country, not, however, in order to teach, but to learn by observing the different procedure adopted in various districts.

Kinds of Schools, &c.—Lower agricultural education in Prussia may therefore be classified under the following heads:—

(*a*) Secondary Schools with an Agricultural Bias.
(*b*) Lower Agricultural Schools.
(*c*) Winter Schools.
(*d*) Itinerant Centres.
(*e*) Special Schools.
(*f*) Schools for Women and Girls.
(*g*) Miscellaneous Courses.

Agricultural Secondary Schools.—The Secondary Schools in Prussia with a well-defined agricultural "side" at present number eighteen. Their position as regards the Agricultural Colleges, on the one hand, and the Lower Agricultural Schools, on the other, is indefinite: they cannot be regarded strictly as preparing their pupils for continuing their studies in agriculture at the University, nor can they be said to have any direct connection with the Lower Agricultural Schools. They do not therefore form a rung in an agricultural educational ladder. Their purpose is to provide an agricultural education combined with the usual secondary education, which combination will lead to the pupils being able to qualify for the certificate allowing them to serve but one year in the army, instead of two or three. This last is one of the most important parts of their constitution, as it is this right that makes these schools definitely secondary, and gives to the teachers in them the corresponding influence and professional status. The general rule is that these schools are combined with, or form part of, a non-classical secondary school, and that in the lower three forms the work is the same in both parts of the school, while the upper three forms are

divided into what might be called in an English school a "modern" side and an "agricultural" side. The position might be compared to an English Secondary School of the new "Municipal" type, where more attention is given to mathematics, science, and modern languages than to classics, if the lower three forms remained as they are now, while the upper three forms were divided into a "modern side" and an "agricultural side." The following table gives an idea of the distribution of work on the "agricultural side" in one of these schools:—

	Fourth Form	Fifth Form	Sixth Form
Languages (German and one other modern language—as a rule, French)	9	9	9
Geography, History, Scripture, and Drawing	7	7	7
Mathematics	5	4	4
Science (including Zoology, Botany, Physics, Chemistry, and Mineralogy)	8	10	8
Agriculture	4	4	6
Gymnastics and Singing	3	3	3
Total hours per week	36	37	37

Some particulars as to these schools, chiefly for the year 1908–9, are given below:—

No. of Schools	18
Total number of pupils	4,293
Of which were—	
(*A*) In lower three forms	1,733
(*B*) In upper three forms—	
(*a*) Modern side	353
(*b*) Agricultural side	2,207
Number of pupils on the agricultural side whose parents were engaged in agriculture	1,212
Number of pupils whose parents were not so engaged or were Foreigners	995
Total number of teachers	220

	£	*s.*	*d.*
Average yearly fee paid by each pupil—			
(*a*) Lower three forms	5	0	0
(*b*) Agricultural side	6	10	0
Estimate of average yearly cost per pupil, including all classes	15	2	0

It will be seen from this statement that no less than 54 per cent. of the boys in the agricultural department of these schools were the sons of parents who were themselves engaged in rural pursuits. It may be assumed that this large percentage is due to the fact that the better class of German landowners and farmers recognise that the education to be obtained in these schools is valuable. In this connection, however, it must not be forgotten that these schools have the right of granting the certificate for one year's

military service, although, on the agricultural side, only one language other than German is taught—a circumstance that might appeal to the father of a dull boy.

Dr. Oldenburg * laments the fact that the ideas of the founders of these schools have in the course of time been lost sight of, since, instead of these schools being purely agricultural and essentially practical, they have developed into ordinary secondary schools with an agricultural "side," as it were, inserted into them, and, instead of being practical in their teaching, they are mainly theoretical. The reasons for this change he does not give, but they are to be found, on the one hand, in the modern tendency to specialise in education and at the same time (by reason of the increase in central government) to limit the number of main categories of educational institutions, and, on the other hand, in the overwhelming influence that matters military exercise on matters purely educational in Germany.

Winter and Whole-time Lower Agricultural Schools.†—Turning now to the Lower Agricultural Schools and to the Winter Schools, we find that they are best considered together; the first are open all the year except during holidays, while the Winter Schools, as their name implies, have only winter courses. These schools are undoubtedly the most important institutions in the Prussian agricultural educational system. Dr. Oldenburg points out that in normal circumstances more than 70 per cent. of Prussian farmers have to look to these schools for their own technical instruction or for that of those of their sons who intend following an agricultural career. In ordinary cases the sons of small farmers have very little opportunity of increasing their knowledge by private study, or by travel, so that the importance of the curriculum and of the methods taught in such schools is very great, since it is only the knowledge that the young farmer carries away with him when he has finished his course at an agricultural school that can explain and turn into right lines the practical experience that he gains in his daily work on the farm.

* *Das Landwirtschaftliche und zweckverwandte Unterrichtswesen im Königreich Preussen*, Dr. G. Oldenburg Berlin, Paul Parey, 1910

† In this section Lower Agricultural School is used as a translation of the term *Ackerbauschule*, where instruction lasts for 1½—2 years, as opposed to Winter School (*Winterschule*) where there are two winter terms in consecutive years.

The history of the Lower Agricultural Schools and the Winter Schools shows how the ideal is influenced by the practical, and how the practical usually gains the victory. The Lower Agricultural Schools had their beginning in a Farm school, where the young farmers worked for two years. Theoretical instruction was combined with practical work on the farm. It was, however, soon felt by the farmers to be a hardship that their sons should be taken away entirely from the parental farm, and so Winter Schools were introduced, which, in two courses of six months each, supplied theoretical instruction, while the practical work was done during the busy season by the students working on their fathers'-farms. This system was found to meet almost every need, and for this reason it is interesting to compare the growth of these Winter Schools with the backward movement of the other institutions.

Year—	1875-76	1882-83	1890-91	1898-99	1902-03	1908-09	1911	1908-09 compared with 1875-76
				NUMBER OF SCHOOLS.				
Lower Agricultural Schools ...	26	33	27	26	19	17	16	-9
Winter Schools ...	12	38	61	103	119	184	212	+172
				NUMBER OF PUPILS.				
Lower Agricultural Schools	583	696	1,061	964	1,032	1,011	*	+428
Winter Schools ...	164	885	2,235	4,102	4,753	7,273	9,357	+7,109

* The number of pupils at the end of the Summer term was 406; the number of new pupils who remained during the whole Winter session was 713

This table shows clearly that the Prussian farmer is very desirous of helping his son to obtain technical instruction in farming, so long as it does not interfere too much with the aid that he expects to get from his son in working his farm. It must be remembered in this connection that these farms are for the most part only from 5 to 50 acres in extent. The success of the Winter Schools is, of course, largely

due to the fact that the pupils who enter them are already well acquainted with the practical side of agriculture, and are therefore in a position to make good use of the theoretical instruction that they offer. They are also cheaper to maintain, since a smaller staff can deal with theoretical work than with practical demonstrations, and naturally, too, a small farmer can better afford to pay fees for two courses of six months than for two one-year courses. Dr. Oldenburg also sees a great advantage in the fact that the teachers in the Winter Schools can be utilised during the summer months as peripatetic teachers, which is not only to the teachers' own advantage, since they are thereby enabled to gain constant practical experience and so improve their theoretical teaching, but it is also to the advantage of both the school and the farmers, who are kept in touch with the institutions where they themselves were educated, and where they expect to send their sons. There can be no doubt that the popularity of the Prussian Winter Schools among farmers is largely due to the peripatetic teachers. It may also be observed here, as regards the Lower Agricultural Schools (not Winter Schools), that not only has their number decreased, but that their nature has altered; they were originally small Farm Schools, giving practical and theoretical instruction; those that still exist are larger schools, giving for the most part only theoretical instruction.

Before giving statistics as to these schools and commenting on the financial and administrative conditions by which they are governed, it will help to a better understanding of their nature if an example is taken and the curriculum described. It must not be forgotten, however, that the conditions vary in different provinces, and that there is no scheme that is applied to all of them; in fact, as is pointed out later, the tendency at present is towards decentralisation. Also, although a Winter School is described, the conditions in a Lower Agricultural School are very similar.

The school of Marienburg, in West Prussia, will serve as a good example. This school is affiliated with the Agricultural Secondary School of the same name, and the headmaster of the Secondary School is director of the Winter School. The regulations of this school follow the regulations of the Province, and impose certain conditions, such as the age of the

students, their previous education (*e.g.*, they must at least have passed through an Elementary School), and the production of certificates as to the personal character of both the prospective student and of his parents, before permission to attend the school is given. The course includes two winters, and lasts in each year from about the middle of October to the end of March. The time table (in hours weekly) is arranged on the following model:

	First Winter	Second Winter
German (Essay writing, etc.)	4	2
Practical Mathematics	5	4
Geography and History	2	2
Chemistry, Physics, &c.	5	5
Agriculture	3	3
Plant-life and management	4	4
Animal-life and management	6	6
Farm management and Book-keeping	4	4
Agricultural Laws and Regulations	2	2
	35	32

In addition, there are excursions and debates. From time to time, instruction is given in leather-work and similar practical subjects. The fee is £1 10*s*. for each winter. In addition to the Director of the School, there are three teachers for technical subjects and two other teachers; the technical teachers are engaged also in peripatetic work; in 1908-09 the number of students in the first-year class was 33, and in the second, 21; the parents of the whole 54 were engaged in farming. It is difficult in this particular case to give the exact financial position, on account of the School's connection with the Secondary School, but the average normal expenditure in such a school would be about £450, of which sum 25 per cent. might come from the fees and other receipts of the school, 30 per cent. from the State, and the remaining 45 per cent. from the Provincial and Local Authorities.

The administrative and financial policy in connection with the whole system of these local agricultural schools was settled in its broad lines as far back as 1875, when it was decided that the control over these schools should be local, and that the bulk of the money necessary should be provided from local sources. At the same time, however, certain grants were made from the State, but on the understanding that they were not to be increased with increased cost of the schools. The result of this policy has not only been that the growth of lower agricultural education in Prussia has depended in the

different districts on the enthusiasm or lack of enthusiasm shown by the local authorities, but, what is more important, the schools have developed according to local needs, and the type of instruction given in each district is in accordance with the needs of that district. The value of the freedom that has been given to the different provinces has undoubtedly been very great, although in some cases, from lack of appreciation of the importance of their responsibilities, an undesirable tardiness has been shown by the local authorities. The number of these schools has much increased in the last few years, and this increase has been largely brought about by the indirect aid given by the State, in that large grants have been made for the peripatetic work, carried on for the most part by the teachers in the Winter Schools.

It is not proposed to enter here into details of the relations between these schools and the local authorities. As a rule, the administrative power is in the hands of a definite local authority (*Kreisverband*) or of the Chamber of Agriculture; in most cases, however, although one of these two bodies may have the actual control, both share the responsibility of finding the money.

The table on p. 9 * shows the distribution of these schools in the various provinces; the area of each province has been added to allow of comparison; this area is, however, the total area of each province, and has no reference to land under cultivation; the area of agricultural land in square miles (taking 1 ha. = 2½ acres) to a school, and the number of farms to a school is also given; the total cost column includes expenditure on peripatetic work (taking 1 mark = 1*s*.).

The total cost for Prussia of these schools (*Ackerbau-* and *Winterschulen*) for 1908–09 was provided as follows:—

	£
By fees, etc	21,552
,, the Provinces	15,993
,, the old grant (*Dotationsrente*)	7,272
,, the Local Authorities	16,630
,, Agricultural Societies, etc	3,297
,, State Grants for peripatetic work	23,085
Total cost † provided for	87,829

* These figures refer to 1907: by 1911 the total number of both classes of schools had increased to 228 with a proportionate increase in the total expenditure.

† By the financial year 1911 this had increased to £110,999.

It should be noted that the "old grant" above-mentioned is the grant that was made over to the Provinces at the time of the decentralisation in 1876 as an endowment.

The present position of these schools is satisfactory. The great requirement of schools of this type is that they should

Distribution of Schools in Provinces in 1907.

Province.	No of Lower Agric Schools	No. of Winter Schools	Total Cost 1907.	For every School there are of Agric Land	For every School there are of Farms	Area of the Province in sq miles.§
			£	Sq. miles	No	
East Prussia	—	15	5,390	464	4,585	14,786
West Prussia	—	9	3,171	477	4,934	9,861
Brandenburg	3	8	6,252	643	6,246	15,383
Pomerania	1	6	7,515	610	7,204	11,631
Posen	—	10	3,589	471	6,380	11,190
Silesia	1	10	6,223	597	9,038	15,569
Saxony *	1	12	6,389	383	4,690	9,752
Schleswig-Holstein	2	9	4,956	460	4,184	7,338
Hanover	5	32	14,097	238	2,262	14,870
Westphalia	2	19	9,883	216	2,391	7,804
Hesse-Nassau	—	13	4,249	339	6,529	6,062
Rhine	1	40	11,532	110	1,797	10,423
Hohenzollern	1	1	487	96	1,808	441
Total or Average	T. 17 †	T. 184 ‡	T. 83,733	A. 320	A 3,758	T 135,110

* The Province, not the Kingdom of Saxony † By 1911 these had decreased to 16. ‡ By 1911 these had increased to 212 § These figures are those given in the *Statesman's Year-book*, 1912

enjoy the confidence of the farming community and be allowed to develop according to the needs of the districts in which they are situated. It has already been shown that the farmers send their sons in large numbers to the Winter Schools, and the peripatetic work is steadily increasing the reputation of the schools. The policy of decentralisation, too, has worked well, and allows every opportunity for the satisfaction of local needs. Dr. Oldenburg is, however, of the opinion that the number of schools should be greatly increased. He believes that the smaller the area a school serves, the better it is for the school and the neighbouring farmers, since then the cost of access to the school is diminished and the peripatetic teachers become better known, if the teachers are not allowed to move from school to school, unless under special

circumstances.* He assumes that 40 pupils to a school is a convenient number (thus making two classes of 20 each in a Winter School), and that each farm provides one pupil each generation; the ideal, therefore, would be one school to 1,200 farms.† As we have seen from the table on p. 9, the average in Prussia in 1907 was one school to 3,758 ‡ farms, which, although far from being the ideal ratio as put forward by Dr. Oldenburg, is nevertheless a proof that this form of Prussian agricultural education can compare favourably with that existing in other countries.

Peripatetic Work.—Peripatetic agricultural work in Prussia is carried on in two different ways. In the first place, a large amount of this work is done by the staffs of the schools just described, especially by the staffs of the Winter Schools, who in their free time are employed by the State to perform this work. Reference has already been made to the advantages of this system. In the second place, there are a number of peripatetic teachers in Prussia who spend their whole time in doing this work. These men are employed for the most part by the Chambers of Agriculture, and the necessary funds are supplied to a large extent by the State. Their duties are not limited to the delivery of lectures in the villages and small towns as opportunity offers; they are especially required to see that new ideas and inventions and the progress generally of agricultural science and technique are brought to the notice of the agriculturists in their districts, and to do this they are recommended to make the fullest use of informal conversation and of practical demonstrations to small groups of farmers or to individuals. The tendency is to employ men who have, in addition to an all-round knowledge of agriculture, a special knowledge of some particular branch of the subject, and the convenience of this arrangement is apparent when it is considered that in a country like Prussia, with varying climates, each special branch of agriculture is usually most at home in some one province. The following

* The policy of not allowing the peripatetic teachers to change their districts when they have once become known is controversial.

† It must be remembered that many of these "farms" are very small indeed.

‡ This ratio is at present still nearer to Dr. Oldenburg's ideal; the exact figure cannot however be given.

table indicates the number and provinces of the various Prussian whole-time agricultural peripatetic teachers:—

Special Subject or otherwise	East Prussia.	West Prussia.	Brandenburg	Pomerania.	Posen.	Silesia.	Prov of Saxony.	Schleswig-Holstein	Hanover.	Westphalia.	Hesse-Nassau.	Rhine	R-B Sigmaringen.	State Total
General ...	2	2	1	—	1	1	1	1	—	—	1	—	—	10
Corn-growing	—	—	—	1	—	—	—	—	—	—	—	—	—	1
Animal-breeding	2	1	3	—	1	1	2	1	1	2	3	3	1	21
Pig-breeding	—	—	—	—	—	—	1	—	1	—	—	—	—	2
Dairying	1	—	—	—	—	—	1	3	1	2	—	1	—	9
Horse-breeding .	—	1	1	—	—	—	1	1	—	1	—	—	—	5
Blacksmith's work	1	1	—	—	—	—	1	—	—	—	—	—	—	3
Poultry breeding	—	1	1	—	1	1	1	1	—	1	—	1	.	8
Fruit cultivation	3	1	1	3	2	3	3	1	1	1	1	1	—	21
Fruit and vine cultivation	—	—	—	—	—	—	—	—	—	—	2	—	—	2
Vine cultivation .	—	—	—	—	—	—	—	—	—	—	—	4	—	4
Flax ,,	—	—	—	—	—	1	—	—	—	—	—	—	—	1
Co-operation	—	—	—	1	—	—	—	—	1	—	—	—	—	2
Book keeping .	—	—	—	—	—	—	1	—	—	—	—	—	—	1
Total	9	7	7	5	5	7	12	8	5	7	7	10	1	90

The table on p. 12 shows the financial position * of this work. In this connection, it should be noted that the State contributions are large compared with those from local sources, and it must not be forgotten also that these figures do not include the State aid given to the staffs of the Winter and other Agricultural Schools in aid of the peripatetic work carried on by them.

Special Schools.—In addition to the schools that have already been described, there are a large number where instruction is given in some special subject. These schools are supported partly by the State and partly by the local authorities. It is not proposed to discuss the details of management of these schools; it may be said, however, that the period over which the instruction extends varies greatly. Sometimes it is more or less similar to the scheme adopted in the Winter Schools; frequently it lasts only for a day each week for a year or a period of years; sometimes it is a few weeks in the summer; the period depends in every case on

* In 1907, taking 20 marks = £1.

the particular subject and the convenience of those who find it advisable to study that subject. In some cases these schools —as, for example, the Schools for Bee-keepers—are used as research institutions and carry on intelligence work; the teachers may also be engaged in peripatetic work.

Financial Position in Relation to Peripatetic Work in 1907.

Special Subject of the Peripatetic Teacher or otherwise	Number of Teachers	Total Funds	Funds obtained from			
			State	Local Authorities	Agric Chambers	Other Sources
		£	£	£	£	£
General	10	2,354	1,804	100	450	—
Corn-growing	1	200	140	—	60	—
Animal-breeding ..	21	6,377	4,225	300	1,852	—
Pig-breeding . .	2	533	340	—	193	—
Dairying	9	1,728	975	—	753	—
Horse-breeding .	5	1,056	744	—	312	—
Blacksmith's work ..	3	402	325	—	77	—
Poultry work	8	1,268	1,030	—	238	—
Fruit cultivation .	21	4,333	2,775	498	1,060	—
Fruit and vine cultivation . . .	2	210	120	60	30	—
Vine cultivation .	4	775	433	342	—	—
Flax cultivation ...	1	111	99	—	12	—
Co-operation ...	2	760	530	—	175	55
Book-keeping .	1	195	195	—	—	—
Total... ...	90	20,302	13,735	1,300	5,212	55

The following table gives some idea of the extent of this work:—

	Number of Schools	Number of Pupils in 1908
Schools for meadow and grass cultivation	5	460
Schools for gardeners and vine growers	15	405
Schools for dairy work	14	225
Schools for bee-keepers	3	47
Schools for blacksmiths	65	785
Schools for poultry keepers	7	78
Schools for foresters	4	195
Total . .	113	2,195

Special Courses.—A large number of special courses on various subjects are held for the benefit of agriculturists in all parts of Prussia. A small number of these courses are of a quasi-scientific character, are conducted by Universities and similar institutions, and partake of the nature of University Extension Lectures for Farmers. The majority of these

courses, however, are short, practical series of lectures on such subjects as Book-keeping, Manures, Pig-breeding, &c.

From the following table it will be seen that these courses reach a large number of people, and are apparently highly appreciated; it must, however, be noted that the majority of them last for a few days only :—

	Number of Courses, 1908	Number of those attending, 1908
Courses of University extension type	11	2,300
Other courses ...	1,020	23,068
Total	1,031	25,368

In addition to the agricultural educational organisations already discussed or mentioned, there are courses of instruction for country women and girls in domestic economy and similar subjects; there is also a large amount of continuation school work carried on which affects the agricultural population in various ways; and finally a system of Training Colleges for agricultural teachers is established in order to supply the necessary pedagogic training to teachers who possess the theoretical and practical knowledge that is required for agricultural education, but who have had no teaching experience.

General Remarks.—In the foregoing summary of the position of lower agricultural education in Prussia, two points have arisen on which stress may be laid in view of the present position in England and Wales with regard to this branch of technical education.

The first is the tendency shown by Winter Schools to increase and by the Lower Agricultural Schools to decrease. This seems to be due to the fact that the agricultural population from whom the students are mainly drawn appreciate theoretical education given in winter, but do not appreciate practical instruction during the rest of the year, when equally good and at the same time paid practical experience can be obtained on farms. The important inference would appear to be that schools with farms attached have been shown to be for the most part not necessary as long as the class from which the students are taken is an agricultural one; in cases where they are not so drawn the argument applies, or does not apply, according to whether a

period of apprenticeship is, or is not, required, before attending such a school. Special reference was also made to the decentralisation of lower agricultural education and the payment of a small fixed sum as State aid with indirect assistance given in the form of grants for peripatetic work. This system appears to have worked well as soon as the local authorities and local agricultural societies had realised their responsibilities in the matter; in considering this financial system as a possible system on which to base the educational activities as regards agriculture in any other country, the political position of agriculture in Prussia must not be lost sight of.

The second point is that the Prussian educational system does not provide the educational ladder so frequently insisted on in this country; the fundamental idea is rather that equal opportunities are offered theoretically to everybody, but that whether these opportunities are utilised to the full depends on the financial position of a boy's parents when he is still very young. In agricultural education in Prussia this is particularly the case. The educational facilities that are offered are suitable to the various classes requiring them, and are so arranged as to correspond to the needs of these particular classes, but do not supply anything in the shape of an educational ladder. It is almost impossible for a young man who has not received an advanced secondary school education to gain entrance to a University or Technical College as an ordinary student, however promising his technical attainments may be. To prevent misconception, however, it should be understood that University and higher education generally is very cheap in Prussia, and, providing the *right start* has been made, there are no artificial difficulties in the path of the humblest aspirant to the highest academic and professional honours.

THE DESTRUCTION AND DISPERSAL OF WEED SEEDS BY WILD BIRDS.

WALTER E. COLLINGE, M.Sc., F.L.S., F.E.S.

I.—DESTRUCTION OF WEED SEEDS.

No one will deny that birds annually destroy a large quantity of the seeds of various weeds. The inspection of an acre of truck land in the autumn is recorded by Judd (5) as giving some idea of the work of weed-destroying birds. "Crab-grass and pigeon-grass formed a low undergrowth, while lamb's-quarters, pigweed, and giant ragweed from 6 to 10 ft. high rose in a thick weed forest. A flock of fifteen quail foraged in the centre of the area, twenty-five doves were scattered over the upper end, and fully two hundred native sparrows scurried about at the lower end, while a band of three hundred goldfinches clung to the ragweed stalks plucking off seeds.

"If we make the fair assumption that the birds remained on this acre of plenty long enough to obtain a full meal, we can reckon approximately the destruction wrought. At a moderate estimate twenty seeds apiece may be allowed for the goldfinches, a hundred for the sparrows, provided that they were from crab-grass or pigeon-grass, and five hundred for the doves and bobwhites, or a total of 46,000 seeds destroyed at a single breakfast."

Writing of the bobwhite, the same author refers to three coveys of these birds. One bird of the first covey was shot, seven of the second, and five of the third. The stomach contents were examined and showed that the thirteen birds had taken weed seeds to the extent of 63 per cent. of their food. Thirty-eight per cent. consisted of ragweed, 2 per cent. of tick-trefoil, partridge pea, and locust seeds, and 23 per cent. of miscellaneous weed seeds. Although the stomachs and crops were not well filled, the birds had eaten 5,582 weed seeds.

In other cases (4) Judd records the finding of three hundred seeds of amaranth in the stomach of one Nuttall's sparrow, and three hundred seeds of lamb's-quarters in a second; in a tree sparrow seven hundred seeds of pigeon-grass were found, and in a snowflake (*Passerina nivalis*) were 1,500 seeds of amaranth.

Beal (1) has estimated the amount of weed seeds eaten by

various sparrows during their winter sojourn in the State of Iowa at about 875 tons.

II.—DISPERSAL OF WEED SEEDS.

We have evidence that the food of many wild birds consists, for a considerable part of the year, of the seeds of weeds and other plants, and it has, all too hastily, been assumed that such seeds are destroyed, either before being swallowed or in their passage through the intestinal canal. Such, however, is not always the case.

Judd (4) writing of the relation of sparrows to agriculture, states: "During January and February, 1900, a series of experiments was carried out to ascertain how far sparrows are responsible for the dissemination of the seeds upon which they subsist. The only birds available for these experiments were seven English sparrows, but the conclusions reached are, in a measure, applicable to all sparrows. The birds were fed on seeds of different weeds, and all their droppings were examined to ascertain the condition in which the seeds were voided. The seeds of climbing false buckwheat and ragweed were found to be thoroughly pulverised, although quite a number of small fragments of the black, shiny coats of the former were found in the droppings. This result was expected, since the birds crack these seeds before swallowing them. The seeds of lamb's-quarters and amaranth were next tried. These, because of their small size and hard structure, it was supposed, would be swallowed whole, and would partially escape destruction in their passage through the bird's digestive tract. But such proved not to be the case. The birds cracked them as they had the others. Halves of seed shells were found in the seed cup, and many broken, smaller pieces; and the droppings of the birds showed no whole seeds, although some few empty split seeds, with the two half-shells clinging together, were found. Usually only the finely pulverised dust of the seed coats was found in the fæces. When the sparrows were not under experimentation they were fed chiefly on millet, the grain of which is enclosed by two corrugated siliceous glumes. These were similarly removed by the birds. No whole seeds were found in the dung, and only an occasional small piece of one of the glumes. The closely related seeds of pigeon-grass (*Chœtocloa*

viridis) are enclosed by much stronger glumes, but when these were fed to the birds the cracking of the grain and the removing of the glumes appeared to be just as complete as in the case of the millet, and seemed as certainly to preclude any possibility of subsequent germination.

Some experiments were made with the seeds of crab-grass (*Panicum sanguinale*). A well-known firm of seedsmen suggested to the (U.S.) Department the probability that the English sparrow was responsible for the occurrence of crab-grass in lawns and golf links sown with pure seed of the finest brand. Much complaint was received from buyers of lawn-grass seed because, after the seed was planted and the turf well established, crab-grass appeared in it, often so thickly as to necessitate ploughing under the whole lawn. Two sparrows were fed with a hundred of the seeds. Instead of manipulating them as they did the seeds of millet and pigeon-grass they swallowed them whole, without removing any of the ensheathing glumes. Gravel was furnished so that the grinding power of the birds' gizzards might be facilitated, and after several hours six droppings were collected and examined. No whole seeds were found. There were, however, three nearly entire glumes and a pulverised mass of matter, which under the microscope was seen to consist of fragments of broken glumes. Several days later about five hundred crab-grass seeds were fed to the same sparrows, no gravel being given at the time or during the interval between the two experiments. Twelve droppings were examined, and the results were substantially the same as in the first experiment. Three different sparrows were then fed with about a thousand crab-grass seeds, and twenty droppings were collected. The result was the same. Not one of the thousand seeds was passed in a condition to germinate. Although these experiments are by no means conclusive, yet they strongly indicate that the English sparrow, however harmful it may be in other ways, cannot be held responsible for the occurrence of crab-grass in lawns."

It seemed desirable, in view of the statement of so careful an observer as Dr. Judd, to institute a series of experiments with the house sparrow and other birds, and the results obtained are set forth below.

In order to test to what extent, if any, different species of

birds were instrumental in disseminating weeds, a quantity of soil was sterilised and then placed in ordinary flower pots, &c. Droppings of the different species were then collected and placed upon the soil and a little fine soil scattered above them. The following tables show the number and different species of plants that were thus cultivated and the number of droppings examined:—

House Sparrow.

No of Droppings	Species of Plants	No. of Plants.
12	Ribwort (*Plantago lanceolata*, L.)	14
	Mouse-eared chickweed (*Cerastium triviale*, L.) .	3
	Groundsel (*Senecio vulgaris*, L.) . ..	12
6	Ribwort (*Plantago lanceolata*, L.) .	5
6	Ribwort .	9
10	Sheep's sorrel (*Rumex Acetosella*, L.) ..	10
	Ribwort	19
12	Daisy (*Bellis perennis*, L.) . .	22
	Ribwort	13
	Mouse-eared chickweed .	7
8	Yarrow (*Achillea Millefolium*, L.)	8
	Creeping buttercup (*Ranunculus repens*, L.) .	11
54	No of species of weeds 7	133

A careful examination was made of thirty-five droppings, and the following perfect seeds were obtained: twenty-two Ribwort, fourteen Buttercup, three Dandelion, seven Chick-weed, nine Sheep's Sorrel, eight Yarrow, eight Dock, four Daisy, and ten Groundsel.

In regard to the greenfinch and bullfinch the results are as follows:—

Greenfinch.

No of Droppings	Species of Plant.	No. of Plants.
6	Charlock (*Sinapis arvensis*, L.) . .	4
	Curled dock (*Rumex crispus*, L.) ...	5
	Ribwort (*Plantago lanceolata*, L.) .	3
14	Curled dock	7
	Dandelion (*Taraxacum officinale*, Wigg.) ..	6
	Knotweed (*Polygonum Aviculare*, L.) . .	9
8	Goose-grass (*Galium Aparine*, L.) . .	5
10	Corn marigold (*Chrysanthemum segetum*, L.)	13
38	No. of species of weeds 7	52

Bullfinch.

No. of Droppings.	Species of Plant.	No. of Plants.
8	Self-heal (*Prunella vulgaris*, L.)	5
	Charlock (*Sinapis arvensis*, L.)	3
	Ribwort (*Plantago lanceolata*, L.)	4
15	Hawkweed (*Hieracium pilosella*, L.)	8
	Charlock	7
	Groundsel (*Senecio vulgaris*, L.)	11
	Mouse-eared chickweed (*Cerastium triviale*, L.)	9
14	Self-heal	3
	Curled dock (*Rumex crispus*, L.)	12
	Ragwort (*Senecio Jacobæa*, L.)	5
10	Sow thistle (*Sonchus oleraceus*, L.)	11
	Hawkweed	6
	Self-heal	3
3	Sow thistle	5
	Curled dock	4
50	No. of species of weeds 9	96

Kerner (6) remarks that the modes of dispersion of fruits and seeds through the agency of animals are almost as varied as the different methods of dissemination by the wind. In many cases such dispersion is brought about by the animals using the fruits and seeds in question for food; the undigested parts are excreted, and any embryos which may have survived the passage through the alimentary canal subsequently germinate. As the fact of this mode of dispersion has been a matter of dispute amongst botanists, and could only be established by experiment, Kerner determined to feed various animals with selected fruits and seeds, and to ascertain, first of all, whether the embryos preserve their vitality after passing through an animal's intestinal canal. For this purpose he took fruits and seeds belonging to two hundred and fifty different species of plants and fed them to the following birds: blackbird, song-thrush, rock-thrush, robin, jackdaw, raven, nutcracker, siskin, goldfinch, serin-finch, titmouse, bullfinch, cross-bill, pigeon, fowl, turkey, and duck; and also the following mammals: marmot, horse, ox, and pig. The fæces were examined after each meal, to ascertain what seeds they contained, and were then laid on a separate bed of earth, and, at the same time, fruits and seeds of the same plants which had not been used for food were planted in an adjoining bed. It would be out of place to set forth here all

the precautions which it was necessary to take in conducting these laborious researches; a statement, however, of the most important results obtained from five hundred and twenty separate experiments will suffice for our purpose.

The birds resolve themselves into three groups in relation to the matter in question. The first group includes those which grind up even the hardest fruits and seeds in their muscular gizzards, which are, in addition, usually filled with small stones and sand. Amongst these, some strip the fruits and seeds when they first lay hold of them, and thereby condemn them to destruction. To this group the following birds of those employed in the experiments belong, viz., the turkey, the common fowl, the pigeon, the duck, the cross-bill, the bullfinch, the goldfinch, the siskin, the serin-finch, the nutcracker, and the titmouse. No seed, under ordinary conditions, was found capable of germination, in the excrement of these birds; only when on a few occasions food was forcibly administered to the fowl and to ducks, so that their crops must have been overloaded, were a few seeds found to have escaped pulverisation, and to still possess the power of development. The seeds used were those of *Arenaria serpyllifolia, Papaver Rhœas, Sisymbrium sophia, Ribes rubrum, Ligustrum vulgare, Fragaria indica,* and other species.

Ravens and jackdaws form a second group, in that the stones of the drupes and hard-coated seeds of the berries which they ate passed uninjured through the intestine, whilst soft-coated seeds and fruits were all destroyed. Kerner emphasises the fact that after these birds had been fed with cherries their excrements contained cherry-stones 15 mm. in diameter, every one of which was able to germinate. Of the birds selected for experiment, the blackbird, song-thrush, rock-thrush, and robin formed the third group. Of these the blackbird was the least fastidious about its food. It even swallowed the fruits of the yew without afterwards relieving its crop of the stony seeds, and it never rejected a single fruit that was mixed with its food. The song-thrush refused all dry fruits of 5 mm. in diameter or more, even when they were mixed with the finely-chopped meat with which the bird was fed. They also voided certain strong-smelling fruits, such as that of the yarrow. On the other hand, the aromatic fruits of Umbelliferæ (*e.g., Bupleurum rotundifolium* and *Carum*

carvi) were eaten with great avidity. The seeds of the tobacco-plant, henbane, and foxglove mixed with the food were not rejected and caused no ill effects, neither did the berries of the deadly nightshade, which were greedily devoured. On the other hand, however, a song-thrush sickened after eating berries of *Phytolacea*. When fleshy fruits with seeds of diameter exceeding 5 mm., such as those of *Berberis, Ligustrum, Opuntia*, and *Viburnum* were introduced into the crop, the pulp passed into the gizzard, but all the seeds were thrown up. Many seeds, as, for example, those of *Lychnis flos-jovis*, were carefully removed from the rest of the food with which they had been mixed. The seeds of fleshy fruits which were greedily devoured were thrown out of the crop if the stones which they enclosed measured as much as 3 mm.

The interval of time between ingestion and evacuation in those species belonging to the third group was surprisingly short. A thrush fed with *Ribes petræum* at 8 a.m. excreted numbers of the seeds after the lapse of three-quarters of an hour, and seeds of *Sambucus nigra* were found to have passed through the alimentary canal in half an hour; but the majority of seeds took from one and a half to three hours to perform the journey. Curiously enough, the small, smooth fruits of *Myosotis sylvatica* and *Panicum diffusum* were retained for the longest period.

Kerner goes on to observe that of the fruit and seeds passed through the intestine, 75 per cent. germinated in the case of the blackbird, 85 per cent. in the case of the thrush, 88 per cent. in the case of the rock-thrush, and 80 per cent. in the case of the robin. The germination of fruits and seeds that had undergone ingestion and excretion was usually (*i.e.*, in from 74 to 79 per cent. of the cases) tardy as compared with that of similar fruits and seeds which had not been treated in this way but were only germinated for the purpose of comparison. In the case of a few berries, however, *e.g.*, *Berberis, Ribes, Lonicera*, the period of germination was hastened by this ingestion; while the seeds of such plants as grow on richly-manured soil, *e.g.*, *Amaranthus, Polygonum, Urtica*, after passing uninjured through the intestines, produced stronger seedlings than did those which were cultivated without such preliminaries.

"From these experiments we may assume that the disper-

sion of edible fruits through the agency of thrushes and blackbirds is not, as was formerly supposed, an exceptional phenomenon obtaining in the mistletoe only, but one that may take place in the case of many other plants, and other observations prove that, as a matter of fact, it does take place. Plants possessing fleshy fruits are undoubtedly disseminated in this manner. The occurrence of such plants as epiphytes upon trees, and also their unexpected appearance on the tops of high rocks and old walls thus receive a natural explanation.

"Seeing that the seeds and stones containing seeds of the fleshy fruits eaten by thrushes and blackbirds only remain a short time in the crop and intestines of the bird, it is probable that the plants in question are disseminated by this agency to the distance of a few leagues at most, in the course of a single year, and that it takes many years to distribute them, step by step, as it were, over large areas. We may reasonably suppose that distribution is affected principally in the direction of those parts of the world towards which thrushes and blackbirds are in the habit of journeying by short daily stages when autumn, the season of the maturity of most fleshy fruits, sets in.

"It is well known that nutcrackers, jays, squirrels, and marmots, keep stores of food in larders, which they fit up in holes in rocks or in the earth or in some secret hiding-place of the kind, and that such fruits and seeds as they conceal there are liable to be left permanently for one reason or another. The hiding-place may be forgotten, or, as is still more likely, the creature that occupied it may fall a victim to a bird of prey. The fruits and seeds may then germinate in the place of concealment, and, inasmuch as the latter is always more or less distant from the spot whence the fruits were taken, this must also be accounted one of the modes of dispersion of the plants in question. I have myself observed this curious phenomenon also in the case of the dissemination of the arolla pine (*Pinus cembra*) by nutcrackers, of beeches, oaks, and hazels by jays, and of hazels by squirrels." (Kerner.)

Pycraft (8) refers to the valuable evidence on this subject brought together by Ridley, "who found that in the Malay

Archipelago the principal carriers were bulbuls, the dark-blue starling (*Calornis chalybea*), the minal (*Mainatus savatus*), and the hornbills (*Buceros*, *Anthracoceros*, &c.), the latter being especially fond of the nutmeg. The parrots of the genus *Palæornis* also aided in this work. The granivorous finches of the genus *Munia* he found aided considerably in the dispersal of adhesive seeds, which were carried about by the feathers and finally dropped. He states, on the authority of Mr. G. Clunies Ross, that on Cocos Islands, "when boobies are not nesting, and have consequently left, the frigate-birds (*Tachypetes aquila*) are unable to procure their ordinary food, which consists of fish taken from the boobies, and that they then swallow seeds of *Guilandina* and beans which they find floating on the sea, and on flying to the land vomit them up again, apparently merely using them to fill up temporarily empty crops."

Darwin (3) mentions that: "In the course of two months I picked up in my garden twelve kinds of seeds, out of the excrement of small birds, and these seemed perfect, and some of them, which were tried, germinated. But the following fact is more important: the crops of birds do not secrete gastric juice, and do not, as I know by trial, injure in the least the germination of seeds; now, after a bird has found and devoured a large supply of food, it is positively asserted that all grains do not pass into the gizzard for twelve or even eighteen hours. A bird in this interval might easily be blown a distance of 500 miles, and hawks are known to look out for tired birds, and the contents of their torn crops might thus readily get scattered. Some hawks and owls bolt their prey whole, and, after an interval of from twelve to twenty hours, disgorge pellets, which, as I know from experiments made in the Zoological Gardens, include seeds capable of germination. Some seeds of the oat, wheat, millet, canary, hemp, clover, and beet germinated after having been from twelve to twenty-one hours in the stomachs of different birds of prey; and two seeds of beet grew after having been thus retained for two days and fourteen hours.

"Other and unknown agencies probably have also played a part. I have stated that fresh-water fish eat some kinds of seeds, though they reject many other kinds after having

swallowed them; even small fish swallow seeds of moderate size, as of the yellow water-lily and Potamogeton. Herons and other birds, century after century, have gone on daily devouring fish; they take flight and go to other waters, or are blown across the sea; and we have seen that seeds retain their power of germination when rejected many hours afterwards in pellets or in the excrement."

Beal (2) has shown that the Wren Tit (*Chamæa fasciata*), the California Thrasher (*Toxostoma rediviva*), and other species disseminate the seeds of poison oak (*Rhus diversiloba*).

Judd (5), writing on this subject, states: "The large consumption of wild fruit results in a wide distribution of seeds, which are voided by birds and germinate where they are dropped. Some observations on crows will illustrate this dispersion.

"On November 17th, 1899, a large flock on the wing was noticed in the distance, . . . they came on down the river in a line that at times stretched almost from one bank to the other. . . . The flock numbered at least a thousand, and hoarse caws and croaks gave evidence that it was made up to some extent of fish crows. After the birds had remained on the shore fifteen minutes they were put to flight by a farmer's boy, and flew on down the river, lessening to specks, and finally disappearing on the horizon.

"Going to the place where they had alighted, I found the sandy beach cut up for more than a hundred yards with their tracks. Many led out to the water, and floating black feathers here and there showed where baths had been taken. The most interesting trace of their sojourn, however, was several hundred pellets of fruit material, which they had ejected through their mouths and dropped on the ground.

"These pellets were about an inch in length and half an inch in diameter. They were of a deep purplish colour, due to the fruit of woodbine, wild grape, and pokeberry, of which they were mainly composed. In fifty pellets collected there were only eleven seeds of other plants, namely, holly, bitter-sweet, and poison ivy. Pokeberry seeds were by far the most numerous. Mr. A. J. Pieters, of the Botanical Division of the (U.S.) Department of Agriculture, germinated

some of them, thus demonstrating the fact that they were distributed uninjured.

"Little is known of the distribution of fruit seeds by crows during migration, but it is certain that they do this work effectively while they fly to and from the roosts where they congregate in winter, for their feeding grounds often cover an area stretching out on all sides from the roost for fifty miles or more."

The same writer records visiting in February, 1901, a crow dormitory, in which probably 100,000 birds slept every winter night. He found strewn on the ground the disgorged pellets, which contained the seeds of poison ivy, poison sumac, and other sumacs, smilax, cedar, sour gum, and flowering dogwood.

On March 27th, 1901, a two hours' search was made beneath a large black walnut tree, remote from other woody vegetation. In all, 172 fruit seeds were found, including mulberry, cultivated cherry, wild black cherry, wild grape, woodbine, pokeberry, cedar, sassafras, blackberry, and sumac.

Numerous other cases might be cited, but it will suffice to record one instance that came under my own observation a short time ago. A number of sycamore seedlings were noticed in a newly-made garden enclosed by a high fence, and as the nearest trees of that species were nearly a mile away, it was concluded that the seeds had been washed off the fence, by the rain, from some bird droppings. In order to settle the matter I carefully collected a large supply of droppings from the fence and placed the same in sterilised soil. The following plants were grown:—Sycamore (*Acer pseudo-platanus*), ribwort-plantain (*Plantago lanceolata*, Linn.), mouse-ear chickweed (*Cerastium triviale*, Linn.), broad-leaved dock (*Rumex obtusifolius*, Linn.), groundsel (*Senecio vulgaris*, Linn.), and charlock (*Sinapis arvensis*, Linn.).

Although many writers are of opinion that seed-eating birds are as a class beneficial, I cannot regard them as such, for, to a much larger extent than is generally supposed, they act as distributors of the seeds of weeds. Mason (7) believes that in India birds which eat weed-seeds are of no

value whatever, and observes that they may keep weeds down to a certain extent, but this is of minor importance in a country where labour is cheap and where farming is not practised on such intensive lines as elsewhere. Even in intensive cultivation we cannot rely on weeds being kept down by birds, and the expense of cultivation to eliminate weeds is, I believe, not reduced in the slightest by the action of birds. We cannot expect the complete elimination of any one of the commoner weeds by the agency of birds alone. If any species of bird fed almost entirely on one species of weed and there seemed to be every possibility of that weed being eliminated, the bird, finding its food supply diminishing, would migrate.

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DRAINAGE OF AGRICULTURAL LAND.

C. T. BAINES.

IN view of the great increase of small holdings and occupying ownership during the past three years, it is thought that a few notes on land drainage may be of service, the work having been largely carried out hitherto by the landowner as distinct from the occupier. It cannot be too strongly emphasised that so long as land requires draining it is difficult to farm it profitably. Water-logged ground retards the germination and growth of all crops essential to economic farming, whilst encouraging the growth of useless and even harmful vegetation. In spite of this fact, however, it is often found that the younger generation of the agricultural classes

has little real knowledge of draining, the art, together with that of thatching and hedge-laying, being generally confined to the older generation. Probably the chief reason for this condition of things is that an enormous amount of land was drained by means of loans made under Government sanction under the superintendence of competent land agents and surveyors between 1865 and 1885. Now that land is let in smaller quantities, it may be difficult to obtain professional advice without incurring considerable expense. It is noted with satisfaction that in many districts prizes are offered to the younger generation for hedge-laying and thatching, but similar encouragement for land draining does not seem to be forthcoming to the same extent. Prizes are given in Hertfordshire, however, for land drainage, following on instruction in the subject.

Deep and Shallow Draining.—At the present time a strong feeling towards shallow draining is noticeable. It is not too much to say that thousands of acres drained some forty years ago reap little benefit at all from the outlay to-day. This is owing to the then prevalent idea that deep draining was advisable. Theoretically, there is, no doubt, much in favour of deep draining. Providing that the ground lying between the pipes, and, say, 18 inches from the surface, is replaced by stone, engine ashes, hedge trimmings, &c., any water which may be found in intervening strata should percolate down to the pipes and be carried away. It has been found in practice, however, that such is not the case. In strong clay soils percolation ceases in the course of years, and the land once again becomes water-logged, and the pipes, often buried at a great depth, become useless. Some of the disadvantages of deep draining are:—(1) Great expense; (2) the necessity of constant attention to the ditch into which the system discharges; and (3) the consequent making up of outfalls. The advantages of shallow draining are, of course, the converse to these, viz.: (1) Less expense; (2) outfalls easy of access; (3) defects in system easily remedied.

The depth of the drains and their distance apart largely depend upon the nature of the soil. In some sandy soils, drains 4 ft. deep, or even more, and placed one chain apart,

will have beneficial effects, whereas in heavy clay soils shallower drains closer together become a necessity.

Before any system of under-draining is decided upon, however, it is advisable to find out if the water-logged condition may not be due to negligence in scouring out the ditches. If this essential work has been omitted it is possible that the outfalls of some old system may be blocked. The liberation of these outfalls may in whole or part remedy the evil at a nominal expense.

Selection of Pipes.—The pipes used for land draining should be well burnt, true in bore, free from stone, and should ring when struck together. A slightly brindled pipe is generally preferable to a very red one.

Outfalls.—The outfalls should be chosen with great care. Generally speaking, the fewer the outfalls the better, but the necessity for more than one in a field will depend on many circumstances, the levels being the chief determining factor. Speaking roughly, one outfall should be sufficient for from 9 to 14 acres. It should be adequately protected by a projecting flag and breastwork of brick. A hinged metal flap is advisable to prevent access of rabbits or rats. It will also tend to prevent flood water "backing up" the pipe.

Size of Pipes.—The mains as a rule should be 4 in. in diameter, though under exceptional circumstances they may sometimes be bigger. The main feeders should be 3 in., and the minor pipes 2½ in. in diameter.

Laying of Pipes.—It is very important that the pipes should be carefully laid. The whole system may be rendered ineffective by the pipes not being properly bedded. The top spit should be carefully thrown out, and not buried by the subsoil, so that it may be correctly replaced when the drains are filled in. Proper draining spades or tools are made for the removal of the lower spits, and a scoop called a "crumber" or "swan neck" is used to scoop out the loose soil and to smooth the bottom of the trenches for the reception of the pipes. This insures for the pipes a uniform bed, which is essential. The main is laid first, starting, of course, at the outfall, and bearing in mind that it should be not less than 2½ in. below the level of the main feeders.

Junctions.—In every case where a drain discharges into another one, the lesser one should not enter at right angles, but should be eased off so as to follow and not impede the flow of water. The junction should be effected by cutting a hole either on the top of the larger pipe and chipping away enough of the smaller to fit it, or by letting the smaller pipe into the side of the main by cutting an accurate hole in the main and cutting the branch pipe bird's mouth fashion to fit the hole. It should be most carefully protected by packing with stone, broken pipes, or by clips specially made for the purpose.

Fall.—In circumstances that do not permit of a better fall, the minimum should not be less than a fall of 1 in 300 (1 in. in 25 ft.), but a fall of not less than 1 in 144 (one-quarter inch in a yard) is advisable when possible. In all cases a level and staff should be used, and a straight edge as the work progresses. Water when available will, of course, confirm other tests.

Replacing of Soil.—The replacing of the subsoil should be carefully carried out, and no ramming allowed until close to the surface. The soil and turf should then be replaced, allowance being made for subsidence.

Characteristics of Water-logged Land.—Every farmer will recognise the signs denoting stagnant water in soil, *i.e.*, the sourness of the ground and the increased growth of deleterious grasses, such as carnation grass, tussock grass, &c. On arable land crops do not flourish, and on pasture land grass grows badly, and stock do not thrive, while snow lies on the fields after it has disappeared from adjoining fields.

Setting Out the Work.—The draining system should consist of three parts:—

(1) The main, into which all other drains eventually find their way before it discharges into the dyke; in ordinary cases this should consist of 4 in. pipes. In exceptional circumstances a 6 in. pipe may be necessary.

(2) Main feeders 2½ in. or 3 in. bore, which in heavy soil should enter the main at intervals of about six yards. It is advisable to cut these drains at right angles to, or obliquely across, and not immediately up the slopes, so as to intercept water which would otherwise merely run parallel with or not be reached by the drain.

(3) Herring-bone or minor pipes of 2½ in. bore should search out all parts of the field and connect up with the 3 in. feeders, if the latter were found necessary. They should be spaced according to the special requirements, as they are the pipes that conduct the water into the main and are essential to the efficient drainage of the soil.

Cost.—The cost of the drainage largely depends upon the average depth of the drains and the distance that the pipes are set apart. This, of course, must vary greatly according to the soil, and it is difficult to say how many pipes per acre will be required, but roughly it may be taken that 2,000 to 2,500 minor pipes, and 100 4 in. pipes for the main will be required per acre. In the following example it is assumed that there is one main only, and that the minors are 7 yards apart; the *average* depths being—mains, 2 ft. 6 in., feeders, 1 ft. 6 in. to 2 ft. (it is hardly necessary to add that such shallow drains could only be used in land under permanent grass). The cost of labour greatly depends on local circumstances. In some parts the recognised price is 2*s*. 8*d*. per "acre," *i.e.*, 28 yards of cutting, laying, and filling at a depth of 2 ft. In other parts, the price is 8*d*. per rod, *i.e.*, 16½ ft., and in others 2*s*. per chain, for the same work. The cost therefore works out as follows:—

	£	s	d.
2,200 2½ in pipes at 25*s* per 1000 .	2	15	0
100 4 in pipes	0	4	6
Labour—cutting, laying and filling 34 chains at 2*s* per chain . . .	3	8	0
Labour—cutting, laying and filling main drain at 2*s* 6*d*. per chain . . .	0	3	9
Total cost per acre	£6	11	3

In round figures the cost may be taken to vary from £5 to £8, according to local circumstances (*i.e.*, distance from brick kiln or station), and the nature of the ground to be drained.

THE CULTIVATION OF THE MUSHROOM
(*Agaricus campestris.*)

E. BECKETT.

To the fact that this edible fungus is so unlike anything else usually grown in a kitchen garden is no doubt due in a large measure the neglect of its culture. True, some

growers have for a number of years cultivated mushrooms in considerable quantity in response to a keen demand on the part of the general public, but others, more particularly the smaller growers, have always regarded the crop as somewhat of an uncertainty. Failures have been ascribed to bad spawn—especially when the crop has been grown inside, perhaps the most general way with small growers—to the unsuitability of the structure, or to the quality and preparation of the manure.

Mushrooms may be grown either out of doors or inside provided that proper attention is devoted to them, and excellent crops may be relied upon in both cases. It is beyond doubt that their culture could with advantage be greatly extended.

The Mushroom House.—As to the nature of this, no hard and fast rules need be laid down. It may be an elaborate structure fitted up with glazed bricks and tiles, with electric light and hot water apparatus, or a plainly constructed lean-to shed with thatched roof, or a cellar underground; from any one of these the best results may be obtained. The essential features are absolute darkness and a fairly equable temperature, and to obtain the latter during the warmest months of the year the house, if constructed above ground, should be given a northern aspect, as at that season it will neyer be too cool. An earthen floor will ensure humidity. For winter culture the installation of hot-water pipes will be a distinct advantage, providing the temperature is well regulated.

The spaces for the beds may be constructed of wood or bricks. The latter are much the more durable, though many growers prefer woodwork; it matters not which. If woodwork is chosen it must be strong and durable, especially if it is decided to have another tier for successional beds. This effects economy of space, but at least three or four feet should be left between them to admit of proper working. Each bed should be two feet six inches deep. Less depth would suffice, but the beds will continue in bearing longer and be generally more satisfactory if the depth stated is allowed.

The preparation of the manure for inside beds is important. The manure from corn-fed horses is best; it should be freed from the longest litter, but the shortest straw ought

not to be too searchingly removed. The newly collected droppings should be spread out in a dry shed not exposed to the sun and drying winds, and turned frequently to allow the rank heat to escape. Afterwards the dung may be thrown into a heap and turned occasionally, and whilst still warm be brought together and rammed firmly to form the bed. The temperature should then be tested. A stick in the hands of an experienced person may be a sufficient guide, but a thermometer is more satisfactory. The rise in temperature should be noted daily. Spawning should take place when the heat is on the decline, and at about 80° F. The spawn should be of the best quality obtainable, and procured from a reliable source, as it is folly to use cheap or second-class material. The cakes of spawn should be soaked in water if very dry, though this is only necessary during the summer months, and when they have been left exposed to the air for a long time. They should be broken up into pieces about as large as a hen's egg and inserted in the bed about three inches deep in holes about nine inches to a foot apart, and then firmly covered over. About a week afterwards, if the spawn shows signs of running, the bed should be soiled over, a layer of fresh turfy loam two inches deep, and beaten thoroughly firm, being the best for the purpose. If this is at all dry it should be watered with a rose-can; a hard surface will be no deterrent to the crop. Then on top of the soil should be placed a mulching of clean straw, which will prevent undue evaporation of moisture. The date of spawning should then be noted.

The interval from the time of spawning until the beds commence to bear varies, but if all goes well in about six to eight weeks' time young mushrooms may be expected, and as soon as these are noticed the mulching should be removed, as in a warm structure it tends to harbour insect and other pests—wood-lice in particular. Throughout the season of growth the temperature should be kept between 55° and 60° F., according to the conditions out of doors, and damping down should be done as often as necessary to ensure a humid atmosphere. This will be governed entirely by the natural surroundings, but the walls and paths should be kept damp, using as little fire heat as possible, and by way of providing additional warmth some newly gathered droppings should be spread in the pathway and turned once or twice daily.

The gathering of the crop is an important feature. The mushrooms should never be cut off with a knife, but given a sharp twist and pulled clean out, the lower portion of the stem being cut off afterwards. The beds must not be allowed to become dry. They should receive periodically a good soaking, using water properly chilled, and beds that have been in bearing some time may be rejuvenated by watering with properly diluted liquid farmyard manure. Some beds, if allowed to remain, will continue to bear more or less for a long time, but usually it is best and most convenient to clear out the old manure, which is extremely useful and valuable in a variety of ways, and use new material for another crop. Spawn inserted in a bed in a warm house, such as that used for cucumbers, and especially if the soil is of a loamy nature, will often yield good crops of luscious, excellent quality.

Those who have not the convenience of a mushroom house, cellar, or any other suitable place, may with confidence try the formation of a bed out of doors, provided it is built in time to be coming into bearing in the early autumn. Mushrooms may be cut out of doors, the whole season through, according to when the bed is spawned, though winter-bearing beds need careful attention as to covering adequately. The site for spring and summer bearing beds should be shaded from the hottest of the sun's rays, and the place selected should be slightly above the natural level, so that surface water drains away readily. Beds constructed out of doors differ from those built inside in one respect, *i.e.*, they are ridge formed. The base may be from five to six feet wide, and the structure should taper towards the top, and be firmly trodden and rammed as the work proceeds. The manure requires preparing exactly as for other systems, but excellent crops may be obtained by the use of equal parts of manure and leaves if the latter have not become too decayed, and where a liberal supply of the latter is obtainable their combination with the horse manure is to be recommended, for the heat generated is much more lasting and even.

As previously mentioned, ample covering must be provided both in summer and in winter, and in severe winter weather a layer of straw at least a foot thick and as dry as possible should be superimposed. As favourable opportunities offer the covering straw must be renewed.

Manufacture of Agricultural Products in the United Kingdom.

THE following particulars relating to the manufacture of agricultural products and of products used in the agricultural industry of the country are taken from the Final Report on the Census of Production of the United Kingdom (1907) [Cd. 6320, price 7*s*. 6*d*.] published by the Board of Trade.

Grain-Milling Trade.—The output of the grain-milling trade in 1907, is shown in the following table:—

	Quantity.		Value.	
	England and Wales.	United Kingdom	England and Wales	United Kingdom.
Wheat:—	Cwt	Cwt	£	£
Flour and meal	69,847,000	79,471,000	45,325,000	51,708,000
Offals ..	33,792,000	37,929,000		
Oatmeal	260,000	2,068,000	150,000	1,264,000
Oatmeal Offals and By Products	36,000	685,000	6,000	83,000
Split Peas and Lentils and Pea Flour	208,000	302,000	104,000	146,000
Oil Cake (ground), &c	115,000	192,000	41,000	72,000
Other Meals:—				
Barley Meal and Flour	6,016,000	6,155,000	5,683,000	9,442,000
Bean Meal and Split Beans	775,000	1,245 000		
Maize Meal and Milled Products of Maize (other than Offals)	8,287,000	18,378,000		
Other Sorts (including some Oil-cake Meal)	1,144,000	1,690,000		
Rice. cleaned, milled, or ground	[not given]	1,799,000	[not given]	887,000
Crushed Oats and other Animal and Poultry Feeding Stuffs	2,438,000	2,951,000	852,000	1,006,000
Provender (chopped Hay and Straw)	—	—	59,000	77,000
Offals, other than Wheat and Oat Offals . .	5,000	222,000	1,000	59,000
Farinaceous Preparations (including Pot and Pearled Barley, Patent Oats), &c	[not given]	390,000	[not given]	178,000
Bread, Biscuits, Cakes, and Self-raising Flour	—	—	183,000	183,000
Other Products .	—	—	4,000	7,000
Total Value of Goods Made	—	—	53,300,000	65,112,000
Amount received for Gristing done for Farmers, &c.	—	—	143,000	210,000
Total Value of Goods Made and Work done	—	—	53,443,000	65,322,000

The output of provender and feeding stuffs does not represent the total output of provender in the United Kingdom, but only of such quantities as were returned by millers as part of their output, together with that returned by railway companies as made for their own use. Hay merchants, chaff-cutters, and provender dealers were not asked to make returns of the quantity of feeding stuffs crushed, rolled, broken, cut, or mixed by them, except in the comparatively few cases where the milling of such products formed the greater part of their business. The output of farinaceous materials, bread, &c., and other products also represents only the quantities made by grain millers, and not the total output.

Taking together the quantity of wheat flour and offals produced, and making a small allowance for loss in milling, the total quantity of wheat used in grain mills in the year of return may be estimated at 118,300,000 cwt. The output of flour milled was thus 66 per cent. of the quantity of wheat used (both native and foreign), as calculated on a full year's production from both large and small mills. The remainder of the wheat grown in the United Kingdom or imported was either exported or used (as screenings) for cattle or poultry food, or for the production of wheat starch and other farinaceous products.

Fruit-Preserving Trade.—The output of canned and bottled fruit in 1907 in the United Kingdom was 91,000 cwt., valued at £174,000, and of other preserved fruit (including crystallised fruit, candied peel, &c.), 184,000 cwt., valued at £309,000.

Bacon-Curing Trade.—The table below (p. 36) shows the output of the bacon-curing trade, and is based on returns made by factories and workshops engaged in the curing of bacon and hams and the manufacture of lard, sausages, and kindred products for the wholesale trade.

The firms making returns for the bacon-curing trade were asked to make a voluntary statement respecting the number of pigs which they themselves slaughtered. Firms whose total output was valued at £6,174,000 stated that they slaughtered 1,398,553 pigs, of which 530 were stated to be of their own rearing. Firms with an output valued at £3,424,000 replied that they did no slaughtering, and firms whose output aggregated £892,000 did not furnish any information.

	Quantity		Value.	
	England and Wales	United Kingdom.	England and Wales.	United Kingdom.
	Cwt	Cwt	£	£
Bacon	703,000	1,704,000	2,272,000	5,326,000
Hams	203,000	458,000	754,000	1,663,000
Pork, salted, other than Bacon and Hams	10,000	19,000	23,000	35,000
Lard	489,000	616,000	1,178,000	1,479,000
Grease, Tallow, &c	Recorded by Value only		7,000	38,000
Sausages			543,000	753,000
Heads			66,000	183,000
Sausage Casings			240,000	306,000
Preserved Meats (including Brawn, Tinned Meats, &c)			315,000	383,000
Offals and By-Products			112,000	303,000
Other Products			16,000	21,000
Total Value	—	—	5,526,000	10,490,000

Cattle, Dog, and Poultry Food Trades.—The following table shows the output in the United Kingdom of factories and workshops engaged in the manufacture of cattle, dog, and poultry foods :—

	Quantity	Value.
	Cwt.	£
Cattle Foods (Cake and Artificial Feeding Stuffs)	3,352,000	1,138,000
Dog Foods (including Biscuits)	—	108,000
Poultry Foods	—	85,000
Other Foods for Animals	—	14,000
Animal Medicines, Spices and Condiments	—	36,000
Other Grain Products	—	57,000
Other Products	—	3,000
Total Value	—	1,441,000

In addition to the output shown above, 874,000 cwt. of cattle foods were included in the returns made by other trades, and also cattle foods to the value of £97,000, for which the quantity was not stated. The cake included in this quantity is partly cake-meals and partly compound cake, and is, therefore, to a large extent manufactured from the oil-seed cakes and meals made at seed-crushing mills. The output of "oil,

oil-cakes, and sundries," by the seed-crushing trade was 1,371,000 tons for the United Kingdom, valued at £12,940,000.

Butter, Cheese, and Margarine Trades.—The following table is based on returns made by factories and workshops engaged in the manufacture of butter, cheese, cream, margarine, and similar products, and in the blending of butter. Butter, cheese, &c., made by farmers, is not included, nor the butter, cheese, &c., made by dairies as a subsidiary part of their business or for the purpose of using up surplus milk and cream. Only establishments engaged in the manufacture or blending of butter or in the manufacture of cheese, cream, margarine, &c., on a commercial scale, including co-operative creameries, are covered by the table.

	QUANTITY		VALUE	
	England and Wales	United Kingdom.	England and Wales	United Kingdom
	Cwt.	Cwt	£	£
Butter, made or blended	408,000	1,100,000	2,206,000	5,840,000
Cheese .	53,000	75,000	155,000	193,000
	Imp Gall	Imp Gall		
Cream, sold .	750,000	1,098,000	291,000	398,000
	Cwt.	Cwt		
Margarine (including all kinds of artificial or imitation butter)	745,000	881,000	1,759,000	2,094,000
Other Milk Products, Bacon and Packing Cases . .	Recorded by value only		1,293,000	1,639,000
Total Value . .	—	—	5,704,000	10,164,000

Fertiliser, Sheep-Dip, and other Trades.—The table on p. 38 is based on returns from factories and workshops engaged in the manufacture of chemical manures, sheep-dip, and similar products. Manures produced from sludge by local authorities, and valued at about £20,000, are not included.

In addition to the output shown 437,000 tons of manures, valued at £3,358,000, were returned as produced by other trades, bringing the total output up to 1,622,000 tons, valued at £6,900,000. In this amount various quantities have been duplicated, however, and the total output of manures in 1907

may be estimated at between 1,289,000 tons and 1,589,000 tons, valued at between £5,800,000 and £6,500,000.

	QUANTITY		VALUE.	
	England and Wales.	United Kingdom	England and Wales.	United Kingdom.
Manures—	Tons	Tons	£	£
Basic Slag	[not given]	203,000	—	277,000
Sulphate of Ammonia	[not given]	1,000	—	13,000
Superphosphates .	368,000	525,000	—	1,136,000
Other Manures . .	323,000	456,000	—	2,116,000
Total Manures	877,000	1,185,000	2,464,000	3,542,000
Disinfectants, Insecticides, Weed Killers and Sheep and Cattle Dressings	—	—	—	593,000
Cattle Foods (Cake and Artificial Feeding Stuffs)	—	—	—	211,000

Destruction of Weeds.

DEEP ploughing and thorough cultivation have long been recognised as perhaps the most efficacious means that can be directed to the prevention and eradication of weeds. There are several reasons why such should be the case: (1) Some seeds of weeds rot when deeply buried for a time. (2) Most weeds are killed when deeply ploughed under. (3) Well-cultivated, deep, open soils are most easily freed from the roots of such troublesome weeds as Couch, Creeping Thistle, Onion Couch, the Bindweeds (*Convolvulus*), and Perennial Sowthistle. (4) The seeds of weeds most readily germinate in an easy-working soil with good tilth, so that the seedlings can the more quickly be killed by the use of the hoe, harrows, surface-weeder, &c. (5) The seeds of the cultivated crop germinate more quickly, and the crop grows more rapidly and vigorously, thus being able the more successfully to overcome the competition of weeds; and (6) When a crop is saved for stock purposes from clean well-tilled land, the resulting seed will be freer from the seeds of weeds—and this is perhaps particularly important in the case of the

cereal grains, home stock of which is more often saved for seed than that of any other crop.

It is stated by Anzibor * that in Russia weeds on the average occupy 15 per cent. of the entire area under cultivation, and in some localities 30 to 50 per cent., while the damage done is computed as representing a loss of 20 per cent. of the crop—or, for cereals only, an annual loss of £640,000, a loss "far exceeding that occasioned by drought, hail, insects, and fungus pests." There is therefore every need for a knowledge of successful means of combating weeds in Russia, and Anzibor concludes from observation and experiment that deep tillage may form an excellent means of control. In September, after a rye crop, two adjoining plots were ploughed to a depth of 5½ ins. and 12 ins. respectively, and left open and fallow. In a few days the shallow-ploughed area was covered with green shoots, but the other remained clean and black until the end of the winter.

In April the quantity of weeds on the two plots was determined, and was found to be 58 per square yard on the plot ploughed to a depth of 5½ in., but only 5 per square yard on the more deeply ploughed area. It is argued that it is owing to the deep ploughings which are necessary for beet cultivation that in "the beet zone" weeds have been much reduced, and that the percentage of impurities in cereals is barely ½ per cent., while elsewhere it reaches 5 per cent. The extra cost of deep cultivation is recognised, but the benefits derived are much more than the mere destruction of weeds, as there is a general improvement in the condition of the soil.

The Disinfection of Poultry Houses and Runs.

At this time of the year it is very important that poultry-keepers should pay particular attention to the use of a suitable method of keeping their stock free from the attacks of parasites, and to the thorough disinfection of poultry houses and runs. The common fowl is known to be subject to attack by a great number of different animal parasites,† and the discomfort and

* *Bull. Bur. Agric. Intel. and Pl Dis.*, Oct. 1912.

† See Leaflets No. 57 (*External Parasites of Poultry*), and No. 58 (*Nematode or Round Worm Diseases of Poultry*).

injury which the birds suffer from fleas, lice, and mites, as well as from tapeworms, flukes, and threadworms are very considerable, and are often responsible for heavy losses. In this connection the results of some experiments which have been carried out during the past four or five years, at the suggestion, and under the supervision, of Mr. Hugh H. Aitken, M.A., Chryston, near Glasgow, and which he has communicated to the Board, will prove of interest.

These tests were carried out on several farms where poultry were kept under fair average conditions, but where the birds were nevertheless troubled more or less during the whole year with fleas, lice, and mites. The method adopted for getting rid of these pests was as follows:—Solutions of commercial disinfectants, made up to double the strength recommended for ordinary domestic use, were applied, by means of a watering-can fitted with a fine rose, to the inside of the house, the woodwork and soil of the runs, and to the dust bath. This treatment was carried out weekly. No appreciable improvement was noticed in the condition of the birds at first, but, after a period varying from six weeks to two months from the time of the first application, examination of the birds showed that the parasites were greatly reduced in numbers, and that they gradually disappeared. The stock became healthier in appearance, and the egg production, as compared with that of the previous years, showed an average increase of 15 per cent. One cottager who adopted this method of disinfection, calculated, on the basis of his previous egg records, that the expenditure of 2*s*. on disinfectants had increased his receipts from eggs by 20*s*. to 24*s*. in the year.

In one case the disinfectant was used at a farm where gapes had yearly caused a great deal of trouble in spring; the result was that last year the chickens were practically free from this pest. Wherever young birds are being reared the soil may with advantage be sprayed once or twice with disinfectants. Old coops should also be disinfected before use. Such treatment, however, is not necessary if the place occupied is a new one or has previously been free from this parasite.

Further experiments conducted by Mr. Aitken have confirmed the earlier results. Weekly disinfection is found to be necessary at first, but the interval between the operations

may be considerably increased when once the birds are in a healthy condition and the houses and runs clean. Regular applications at stated intervals are always necessary, and the frequency of the applications should to some extent be determined by climate and by the season of the year.

Where knapsack sprayers or a good garden syringe are available, the suitability of these appliances for facilitating disinfection by this system will be recognised.

Even when this treatment is carried out, it would still be advisable to apply, twice a year, to the interior of the house, to the nest boxes, and to the woodwork of a covered run, a wash of hot lime and soft soap, as recommended in the Board's leaflet No. 57, or to paint all the parts with creosote.

The Turnip Mud-Beetle
(*Helophorus rugosus*)

In reference to the article on this pest which appeared in the *Journal* for May, 1905, p. 102, a further note is of interest. In November, 1911, some sickly turnip plants were submitted to the Board for examination, and it was found that they were attacked by the larvæ of the Turnip Mud-Beetle. The edges of the young leaves were eaten, and pieces were gnawed out of the upper surface of the swollen bases of the leaves, close to where they spring from the stem. The larvæ were found quite in the heart of the youngest central leaves. Dr. MacDougall preserved and fed these larvæ, which, when full grown, buried themselves in the soil provided for them, and there pupated. The fact that pupation took place in the soil suggests that an attack of the Turnip Mud-Beetle might usefully be followed by deep ploughing. A leaflet (No. 143) on this pest may be obtained, post free, on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Use of Liquid Manure for Hay (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Vol.* 13, *No.* 2, *Jan.*, 1913).—This series of experiments, commenced in 1911, was continued on the same lines in 1912. In the latter year experiments were carried out by agricultural instructors at eight centres in six counties, and by agricultural overseers at fifty-four centres in congested districts.

There was very little difference, either in 1911 or 1912, in the yields from plots manured with artificials, liquid manure, or farmyard manure. A summary of the results is as follows:—

	1912.		1911.	
	Average yield per acre	Increase due to manure.	Average yield per acre.	Increase due to manure.
	t c q	t c. q	t. c q	t. c q.
No manure	2 3 1	—	1 18 1	—
16 tons liquid manure	3 1 1	0 18 0	2 11 3	0 13 2
16 tons farmyard manure	2 19 1	0 16 0	2 11 2	0 13 1
1 cwt nitrate of soda, 2 ,, superphosphate, 2 ,, kainit . . .	3 0 1	0 17 0	2 10 0	0 11 3

These figures show the interesting fact that equally good results were obtained from the application of liquid manure to meadow hay in the wet season of 1912 as in the phenomenally dry year of 1911. The Irish Department consider that although this series of experiments requires to be repeated before definite conclusions are drawn, the evidence as to the value of liquid manure as a dressing for hay, whether first crop, second crop, or permanent meadow, should be sufficient to induce farmers to try an experiment on their own land. At present the liquid manure on many holdings is entirely lost, whereas it could be collected at small cost and applied to grass land during winter, when farm work is slack, with benefits out of all proportion to the expense incurred

FIELD CROPS.

Experiments in Barley Growing (*Jour. Dept. of Agr. and Tech. Instr. for Ireland, Vol.* 13, *No.* 1, *Oct.*, 1912, *and No.* 2, *Jan*, 1913).—An experiment with different varieties of barley grown for malting purposes was carried out by the Irish Department of Agriculture from 1901 to

* A summary of all reports on agricultural experiments and investigations recently received is given each month The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

1911, the points dealt with being the yield and market value of the crops, and the value of the crops for malting and brewing purposes. In 1902 Mr. E. S. Beaven found that good quality malting barley was characterised by a low total nitrogen content. In the experiments of the Irish Department the produce of the various plots was malted by Messrs. Guinness, and samples were analysed chemically, and in all cases the figures agreed with Mr. Beaven's conclusions.

In the variety experiments the narrow-eared kinds, Archer, Scotch Chevalier, Hallett's Chevalier, Old Irish, and Danish Archer, and the wide-eared varieties, Goldthorpe and Standwell, were compared. Of these, Archer and Goldthorpe were considered to be the most satisfactory varieties. Archer was good in both yield and quality, and the only objection to it was found to be its late ripening tendency. This, it is considered, can be obviated in ordinary seasons by early sowing. Goldthorpe was also a desirable barley, and on some farms proved as remunerative as Archer. It has, however, a long neck, and is consequently liable to loss by ears falling off the straw. Hallett's Chevalier and Standwell also suffered from this fault.

Considerable difficulty was experienced in obtaining seed of the different varieties pure enough to produce the evenly ripened crop necessary for good quality grain. Consequently seed was raised by group selection, *i.e.*, selection of the best ears from a large number, and also by growing from single ears. The evenness in growth and ripening of the crops and in the final quality and size of the grain were very striking with the seed from single ears. The result was that, whereas the ordinary unselected Irish Archer was in 1906 inferior to Danish Archer by about 11*s* per acre, in 1907, with the hand-selected Irish Archer the difference was reduced to 5*s*. per acre, and in 1908 the single-ear culture of Irish Archer was equal to the Danish Archer in yield and value. The widely-spread idea that a change of seed from one country or district to another is beneficial was tested and, as far as barley is concerned, no support was found for it No difference in either yield or quality was observed between Danish Archer grown in Ireland for one, two, three, or four years, and the same variety freshly imported each season. Further, there was no corroboration of the generally accepted view that imported seed yields a heavier crop in the second than in the first year in which it is grown in the country.

The enhanced value of Irish Archer owing to selection indicated that the reverse process is always liable to take place, and that a quantity of pure seed, if allowed to become contaminated with other varieties, either better or worse in yielding capacity and quality than itself, may become less prolific and also of inferior quality. Such is very probably the explanation of a good deal of what is commonly spoken of as the deterioration of cereal seeds: they become mixed with other varieties, and owing to different habits of growth and times of ripening, the yield diminishes and the produce presents a less attractive appearance year by year.

Recently, another strain of Archer raised by the Department and called Irish Archer 2 has been tested against Irish Archer 1. These experiments were conducted on a small scale in 1911 in the Depart-

ment's cereal cage at Ballinacurra, Co. Cork, and similarly in 1912, while, in addition, last year field experiments with the two barleys were carried out in counties Cork, Kildare, and Louth.

The results obtained show that Irish Archer 2 is a slightly more productive strain than No. 1, and, if anything, also slightly better quality.

A new hybrid broad-eared barley, Beaven's "145," raised by Mr. E S Beaven by crossing an Archer with a broad-eared barley of the Goldthorpe type, was also included in the cage and field trials in 1911 and 1912. This variety is remarkable for its short straw, and particularly its short neck, which renders it immune to loss by the ears breaking off the straw Although it has not returned on an average quite as large a quantity of grain as Archer, it is undoubtedly a valuable barley, especially in districts where broad-eared barleys are cultivated. The grain produced in all trials was of high quality.

For the past four seasons the Department have conducted trials with a variety called Spratt at Birr, King's Co This broad-eared barley is characterised by a stiff straw and is remarkable for the manner in which it can be successfully cultivated on soils of a peaty nature, provided they are drained and not water-logged To light, gravelly soils it does not appear to be so well suited The grain in appearance does not reach the standard of Archer and Goldthorpe, but its heavy yielding propensities on peaty soils render it a valuable variety to cultivate for feeding purposes

Varieties of Picking Peas (*East Anglian Inst of Agric., Chelmsford, Rept. on Field Expts.*, 1912).—The growing of peas for picking is an important industry in Essex, and it was thought that it would be of interest to test the yield of some of the best-known varieties The dry weather at the time of sowing gave the peas a bad start. They recovered, however, after the rain in the first week of June The variety Telegraph was destroyed by an attack of Thrips, but the other crops were good The following yields in bushels per acre were obtained —Gradus, 362, Essex Star, 302; Alderman, 293; and Blue Seedling, 280.

Varieties of Feeding Peas (*East Suffolk County Educ. Com, Rept. for season* 1912)—A large area of feeding peas is grown in East Suffolk, chiefly on second-rate or even inferior land, where it is considered that the more valuable blue peas are too uncertain a crop Blue peas in certain seasons are a very profitable crop. On inferior land, however, or in wet or unsuitable seasons, they sometimes go yellow and give a very poor yield. There are, in addition, cases where, owing to the presence of perennial weeds in the land, it is desirable to grow a long-strawed hardy pea, which will smother the weeds, or at least keep them in check until harvest. In the Eastern Counties peas usually ripen early, so that frequently quite a good opportunity for cleaning the land occurs after the peas are harvested It appears, therefore, that in spite of their lower price, feeding peas possess certain qualities which justify their cultivation, particularly in districts where a large number of pigs are kept, as is the case in East Suffolk.

The principal variety of blue pea grown for grain is Harrison's

Glory. High prices (£5 or more per qr.) are given for first-class samples. The peas are hand-picked, made up into small packages, and retailed for domestic purposes. The chief feeding pea grown is the Partridge pea, a small pea, mottled with brown spots, and with long straw. In a dry year the long straw is useful, but during a wet summer an enormous bulk of straw is produced, and often very little grain.

Tests were carried out in 1912 at one centre only, on a poor, heavy loam, with four varieties of feeding peas, viz., Svalof Solo, Norfolk Early Dun, Baylham, and Black-Eyed Susan. A bad attack of aphides and the drought of April and May were probably responsible for the following poor yields :—Swedish Solo, 114 stones per acre; Black-Eyed Susan, 111 stones; Norfolk Early Dun, 111 stones; Baylham, 98 stones.

Experiments with Mangolds (*East Anglian Inst. of Agric., Chelmsford. Rept. on Field Expts.*, 1912).—*Varieties.*—Six varieties were tried. Although the seed was put in on May 1st the majority of the plants did not germinate until the rains in June. The following dressing of artificials was given per acre :—1 cwt. sulph. of ammonia, 3 cwt super-phosphate, $\frac{3}{4}$ cwt. sulph. of potash, $\frac{1}{4}$ cwt. steamed bone flour, 3 cwt. salt. The drills were 27 in. apart. The following yields in tons per acre were obtained :—Yellow Globe, $35\frac{1}{4}$; Intermediate Red, $30\frac{1}{2}$; Mammoth Long Red, $29\frac{3}{4}$; Yellow Intermediate, 28; Sugar Mangold, 27; Golden Tankard, $25\frac{1}{4}$.

Flat v. Ridge System of Sowing.—Advantage was taken of the fact that the season was very dry at the time of sowing to test the system of sowing on the flat, which has special advantages in a dry season The ground which had not been ridged was moist, and on May 2nd the seed was ploughed in three inches deep. The ground was then harrowed and rolled. The seeds germinated immediately, and were much ahead of those on the ridge The final crop was also 7 tons 17 cwt per acre heavier.

Distance Apart of Drills.—The yield per acre from drills 22 in apart was 38 tons 14 cwt., while that from drills 27 in. apart was 33 tons 3 cwt. The report points out that, notwithstanding the greater expense and labour, the 22 in. drills are probably the more profitable.

Manuring.—The object of the experiment was to determine what mixtures of artificials along with farmyard manure would prove most profitable for mangolds. Seven plots were taken at each of three farms on a light soil, heavy loam, and medium loam respectively. Valuing the average increase of crop on each group of three plots at 15s. per ton, the application of all the mixtures used yielded profits.

The greatest profit (£2 7s. 9*d.* per acre) was given by 15 tons of farmyard manure, 2 cwt. nitrate of soda, $3\frac{3}{4}$ cwt. basic slag, 3 cwt. kainit, and $\frac{1}{2}$ cwt. steamed bone flour, although this mixture was not so successful on the heavy loam as some of the other mixtures tried The results obtained in 1911, which were confirmed in 1912, showed that nitrate of soda and superphosphate, in addition to farmyard manure, are profitable for mangolds, and that basic slag is a more profitable form of phosphate for this crop than superphosphate.

Manuring of Mangolds (*East Suffolk County Educ. Com., Report for Season* 1912).—These experiments sought to ascertain the effect of artificials in combination with farmyard manure, and to compare calcium

cyanamide and nitrate of lime with nitrate of soda and sulphate of ammonia. Dry weather in spring hindered germination of the seed, and the yields were also unfavourably influenced by the wet weather of August, so that the results were in no way conclusive as to the effects of the various manures. The highest yield was given by a mixture of 4 cwt. superphosphate, 1 cwt. muriate of potash, and 290 lb. nitrate of soda per acre, in addition to farmyard manure. Sulphate of ammonia and nitrate of soda in the mixture of artificials gave better results than nitrate of lime and calcium cyanamide.

Western-Wolths Grass (*East Anglian Inst. of Agric., Chelmsford. Rept. on Field Expts.*, 1912).—This grass was sown on May 14th, and cut on July 9th. It yielded 2 tons 2 cwt. per acre of hay. This grass is a quick grower of the Italian Rye Grass type, and reaches maturity in one season. It is recommended for filling up blanks in a thin clover "root," and for sowing after early potatoes for autumn grazing.

Growth of Tobacco in Ireland (*Jour. Dept. of Agr. and Tech. Instr. for Ireland, Vol.* 13, *No.* 2, *Jan.*, 1913).—This publication contains the figures showing the commercial results of Irish tobacco growing in 1911. Twenty growers planted the crop, the amount produced being 134,486 lb on 119½ acres. The average yield was 1,125 lb. per acre, the highest yet obtained, except that for 1908, which was 1,200 lb. per acre The following table shows the cost of production and the returns for each class of tobacco grown :—

Kind of Tobacco	Pipe (average of 6 centres)	Cigarette (one centre).	Cigar (one centre).	Pipe and cigarette (one centre).
Average yield per acre in lb .	1,074	1,543	520	1,496
Cost of production, per lb	6·9*d*	11·3*d*	22 4*d*.	4·8*d*
Amount received, per lb	5 2*d*	6 0*d*	7·1*d*	5·5*d*.
	£ s d	£ s d	£ s. d	£ s. d
Cost of production, per acre	31 1 4	72 11 6	48 18 8	30 3 6
Amount received, per acre ...	23 1 10	38 11 5	15 7 9	33 12 3

The quantity of tobacco produced and the gross return per acre in 1911 showed a marked increase at all centres over the results of the previous two years. This improvement was due to the very favourable season and, in some cases, also to the more extensive use of home-saved seed The cost of production must vary somewhat with the weight of the crop, and should also be affected by the weather, which in 1911 rather facilitated most operations. Taking these facts into consideration, the results do not indicate any marked economies in the cost of production in 1911.

Growth of Millet (*East Anglian Inst. of Agric., Chelmsford. Rept. on Field Expt.*, 1912).—Millet was grown on a small scale. Sown on May 13th, it was ready for cutting toward the end of July. The cost of seeds per acre (20 lb.) was 5*s*. The crop yielded 19 tons per acre of green fodder.

Chinese Lucerne (*East Anglian Inst. of Agric., Chelmsford. Rept. on Field Expts.*, 1912).—The cropping capacity of the Chinese variety of lucerne proved quite satisfactory. It yielded a crop of 8 tons 1 cwt. per acre of green fodder as compared with 6 tons 4 cwt. from the ordinary variety.

FEEDING STUFFS.

Feeding Value of Cacao Husks (*Annales de la Science Agronomique, November*, 1912)—The chemical composition of cacao husks seems to be very similar, but their feeding value rather inferior, to that of bran, judging by the following figures given by Kellner :—

	Cacao Husks.		Bran.	
	Crude Nutrients.	Digestible Nutrients.	Crude Nutrients	Digestible Nutrients.
	Per cent.	Per cent.	Per cent.	Per cent.
Water	10 0	—	13 2	—
Albuminoids	14·3	0·6	14·3	11·3
Fat	6 2	5·2	4·2	3 0
Carbohydrates	46·3	22 3	52 2	37·1
Fibre	15·8	3 3	10 2	2·6
Ash	7·4	—	5 9	—

Compared with the bran in use, the composition of two lots of cacao husks fed to dairy cows was as follows :—

	Cacao Husks (Crude Nutrients.)		Bran. (Crude Nutrients.)
	Lot A.	Lot B.	
	Per cent.	Per cent.	Per cent.
Water	9·36	8·04	13 27
Albuminoids	15·94	12·50	10·67
Fat	2·40	4·38	3 02
Carbohydrates . .	46·48	51·30	48 06
Fibre	17·30	17·70	19·60
Ash	8·52	6·08	5·38

In the experiments bran in the ration was compared with cacao husks in the proportion of 1½ lb. of bran to 2 lb. of cacao husks, these two amounts of the substances having equivalent feeding values according to the above tables. The price of the bran used was about twice that of the cacao husks.

The experiments were continued over four months with 20 cows,

and it was found that the milk yield diminished by replacing bran with the cacao husks, in some cases by as much as 20 per cent. There was, however, a correspondingly large increase in the percentage fat content, so that the total fat content of the milk in the case of the two foods was practically the same.

DAIRYING

Influence of the Stage of Lactation on the Composition and Properties of Milk (*U.S Dept. of Agric., Bureau of Animal Industry, Bull.* 155).—Eleven cows were kept throughout a whole lactation period on a uniform ration, the quantity being varied to suit the individual animal. Composite samples were prepared from the milk of each cow by seven-day periods. The following analyses and determinations were made:—Specific gravity, dry matter, total nitrogen, nitrogen as casein, nitrogen as albumin, fat, sugar, and ash. The following properties of the fat were determined.—Relative size of the globules, Reichert-Meissl number, iodine number, saponification number, refractive index, and melting point. The following facts were noted:—

(1) The total protein was found to be abnormally high following parturition It continued to decline until the third or fourth week, when it reached the minimum It then remained constant until towards the end of the lactation period, when it rose rapidly and reached its maximum.

(2) The range of variation for the total protein was more than that for fat.

(3) The casein constituted 80 to 82 per cent. of the total protein, and seldom went beyond these limits

(4) The albumin bore almost a constant ratio to the total protein, and followed the same variations during the lactation period.

(5) On the average 81 4 per cent. of the total protein was casein, and 7 or 9 per cent. was albumin.

(6) No relation was found between the protein and the sugar.

(7) The per cent of fat declined during the first three months. During the following four or five months it remained fairly constant. After that it rose rapidly to the end of the lactation period.

(8) The variations in the fat and protein were on the whole quite similar, although sudden changes in the fat were not accompanied by similar changes in the protein.

(9) On the average the proportion by weight of protein to fat was as 1 : 1 16.

(10) Excepting ash, the least variable constituent was lactose, which declined slightly towards the end of the period.

(11) The total solids exhibited a slight decline at first, and then, after remaining constant for eight or nine months, there was a rapid rise.

(12) The total protein averaged 27 per cent of the total solids, the casein 22 1 per cent., the albumin 2 3 per cent., fat 31·3 per cent., sugar 3·7 per cent., ash 5 3 per cent.

(13) The amount of ash was quite uniform throughout the lactation period except near the end, when there was some increase.

(14) The size of the fat globules was much influenced by the stage

of lactation. They were at first especially large, but they declined sharply in size during the first six weeks. Then the size remained fairly constant for five or six months, when a rapid decline occurred to the end of the milking period.

(15) The melting point of the butter fat was not influenced to any great extent by the stage of lactation. There was some lack of uniformity between the figures obtained during the first few weeks. Towards the end of the period the melting point rose. This rise was accompanied by a high iodine number and an especially low Reichert-Meissl number.

(16) The refractive index remained practically constant.

(17) On the average the Reichert-Meissl number showed a uniform decrease throughout the lactation period.

(18) At the beginning of the lactation period there was lack of uniformity in the iodine number. After that a gradual rise in the iodine number took place until near the end, when the increase became more rapid.

(19) The stage of lactation was found to exert a uniform effect upon the saponification value. From first to last there was a decline which corresponded to the decrease in volatile acids.

(20) The churning of the cream became more difficult towards the end of the period, and samples were found which could not be churned at all.

(21) An abnormal odour and flavour developed in the milk of certain cows when near the end of the lactation period. This condition was not present in the freshly drawn milk, but appeared within twelve hours, even when the milk was kept at 10° C.

POULTRY.

Utility Poultry Club's Twelve Months' Laying Competition (*Summary of Results for the Fifth Month ended March 4th,* 1913).—The total number of eggs laid during the fifth period of four weeks has been 8,689, or 1,929 more than the total for the fourth period (*Journal,* March, 1913, p. 1032).

The first four pens remain in the same position as last month. Pen 86 (Buff Rocks) is still leading with a total score of 448 eggs of the value of £3 0s. 4½*d*. Pen 60 (White Wyandottes) stands second with a larger total of eggs, viz., 451, but as the eggs are valued by size, the money equivalent of those laid by this pen is less than that of Pen 86. The third and fourth places are taken by the White Wyandottes in Pens 32 and 45 respectively. Pen 40 (White Wyandottes) has risen from seventh place to fifth place, and so holds the position which last month was occupied by Pen 24 (Black Leghorns); this pen now holds the sixth place.

The highest score for the month has been made by Pen 55 (White Wyandottes), which has produced 129 eggs of the value of 11*s*. 3¾*d*. The highest individual score has been made by Pullet No 330 in this pen, with a total of 27 eggs in 28 days; the average production of this pen was over 21 eggs per bird.

The average number of eggs produced by each pen for the month works out at nearly 87; the average per bird at 14½.

The Anconas in Pens 4 and 5 are worthy of note, as the majority of the eggs laid by these birds weigh almost 2⅓ oz.

The weather during the period has been a great improvement on that of last month. Although two deaths have occurred, health throughout the month has been good.

Poultry Experiments (*Maine Agric. Expt. Sta., Bull.* 179).—This Bulletin deals in the first place with certain modifications which it was considered desirable to introduce at the station into the methods of feeding the laying pullets.

All adult birds, whether pullets or not, received (*a*) whole or cracked grains scattered in the litter, (*b*) the mixture of dry ground grains known as a dry mash. The birds were also given oyster-shell, dry cracked bone, grit, and charcoal, together with an ample supply of clean water. In addition clover hay was provided. The whole or broken grains were preferred to the dry mash, but while the latter was taken freely, the birds showed no tendency to gorge themselves with it or to become lazy and over-fat. It is also claimed that by feeding a dry mash in hoppers there is none of the mobbing which characterises trough feeding, there is little or no waste, and the amount of labour is considerably reduced. The dry grains were fed early in the morning, being scattered on the litter, which consisted of a mixture of pine shavings and straw, the amount of whole corn allowed for every 100 hens being four quarts; at ten o'clock they were given in the same way two quarts of wheat and two quarts of oats. This was all the regular feeding which the birds received.

The dry mash formerly used at the station had the following composition :—

Wheat Bran	200 lb.
Maize Meal . . .	100 ,,
Middlings	100 ,,
Gluten Meal or Brewers' Grains	100 ,,
Linseed Meal . . .	100 ,,
Beef Scrap	100 ,,

Experience had shown that this mash, containing comparatively large quantities of such concentrated foods as gluten and linseed meal, was rather too rich.

In considering the most desirable modifications to introduce into a new mash it was necessary to take into account the circumstances connected with the transfer of the birds to the laying houses from the range on which they had grown up, and experience led to the conclusion that this period was a very important one, and that the egg production during the winter was dependent to a large extent on the way in which this transition was made.

It seemed desirable that this change should be effected as gradually as possible, and with this end in view the pullets were transferred from the range soon after September 1st, when they were placed in a house with a freshly seeded yard full of green grass accessible to them and here they remained until cold weather set in. Thus they were brought from a free range to a restricted range, but with better pasturage on the restricted than on the free range. In order to bring

the birds gradually to a rich ration the following modifications were made in the composition of the dry mash :—

First month in laying-house (September) :—

Bran	300 lb.
Maize Meal...	100 ,,
Middlings	100 ,,
Meat Scrap	100 ,,

Second month in laying-house (October) :—

Bran	200 lb.
Maize Meal...	100 ,,
Middlings	100 ,,
Gluten Meal	100 ,,
Meat Scrap	100 ,,

Third month in laying-house (November) :—The mash was similar to that given in October, with the addition of 50 lb. of linseed meal.

Fourth month in laying-house :—The mash had the same composition as that of the second month.

Fifth month in laying-house :—The mash had the same composition as that of the third month.

Every alternate month after this time 50 lb. of linseed meal was put into the mash, as given for the second month. This dry mash was kept before the birds all the time in open hoppers.

The character of the egg production resulting from this method of feeding is shown below :—

EGG PRODUCTION OF 300 BARRED PLYMOUTH ROCK PULLETS, AUTUMN AND WINTER OF 1909.

Month.	Total number of eggs laid.	Average per bird.
September	139	0 46
October	725	2 42
November .	984	3 28
December	2,926	9 75
Totals ..	4,774	15 91

From this table it is evident that the average production made no sudden increase in early autumn, but rose gradually, until in December it rose quite rapidly at the time of year when a high egg average is most desired. On this system of feeding the pullets were found to be much freer from digestive troubles and diseases involving the liver, and there was no moulting in the early winter.

The dry mash used at the station for birds kept as breeders after they have moulted was as follows :—

Bran	400 lb.
Maize Meal...	50 ,,
Middlings	50 ,,
Meat Scrap	100 ,,

From about a month before the birds to be used as breeders (old hens, cockerels, and cocks) were mated up, they received richer food,

and were eventually fed on the third month ration as described above for pullets This method of feeding breeders appeared to increase fertility and the hatching quality of the eggs, and the vigour of the chicks

NOTES ON AGRICULTURAL CO-OPERATION.

Co-operative Agricultural Societies in the United Kingdom.

At the end of the year 1911 there were 768 separately registered societies engaged in agricultural distribution and production, with an aggregate membership of 94,884, and a total capital—share, loan and reserve—of £748,561. Their aggregate sales during the year amounted to £4,526,884, upon which a profit of £62,373 was made. The societies employed 2,748 persons, and paid £126,186 in wages during the year.

In addition, there were 72 industrial societies and one agricultural distributive society which had departments engaged in farming and dairying operations These departments together employed 704 persons, and paid an aggregate wage amounting to £41,071 The total value of their produce was £330,267.

Of the 768 separately registered societies 431, with a membership of 47,473, were "distributive" societies, with a capital of £274,922 Their sales for the year amounted to £2,186,597, on which there was a profit of £20,848 The remaining 337 societies were engaged in production, mainly butter-making, but a few in farming, flax-growing, and threshing These societies had a membership of 47,411, a capital of £473,639, sales for the year of £2,340,287, and a profit of £41,525

The following table shows the distribution between England and Wales, Scotland, and Ireland, respectively, of the whole of the distributive and productive sales in 1911 —

	Sales of Agricultural Distributive Societies	Sales of Agricultural Productive Societies and Departments	Total Sales Amount	Total Sales Percentage of Total
	£	£	£	
England and Wales	1,325,547	297,047	1,622,594	33·4
Scotland	335,470	219,405	554,875	11 4
Ireland	525,580	2,154,102	2,679,682	55 2
Totals United Kingdom	2,186,597	2,670,554	4,857,151	100 0

Thus, more than half the sales of agricultural distributive societies in the United Kingdom were in England and Wales, while more than 80 per cent of the sales of productive societies and departments were in Ireland.

Distribution.—The following table shows the growth of agricultural distributive societies in England and Wales, Scotland, and Ireland, respectively, during the past ten years·—

Year.	England and Wales.		Scotland.		Ireland.	
	No of Societies.	Sales.	No. of Societies.	Sales.	No. of Societies.	Sales.
		£		£		£
1902	29	58,080	1	42,083	126	360,509
1903	48	87,970	2	42,760	136	393,542
1904	65	146,197	2	44,850	155	372,080
1905	82	214,292	5	46,610	150	371,273
1906	111	387,775	8	51,511	161	420,223
1907	121	572,735	12	80,338	163	484,771
1908	131	751,445	19	99,530	157	469,556
1909	145	885,683	31	227,141	160	491,034
1910	165	1,036,515	43	291,838	168	521,193
1911	217	1,325,547	55	335,470	159	525,580

In 1902 the sales in Ireland were more than 3½ times those of England and Wales and Scotland combined, but the movement has made such rapid strides in Great Britain that in 1911 the amount of sales there was more than three times the amount of those for Ireland. Compared with 1910, the year 1911 showed an increase of sales of 27·9 per cent. in England and Wales, of 15 per cent. in Scotland, and 0·8 per cent. in Ireland

Production.—The following table gives the number of societies in each of the two groups engaged in agricultural production and the amount of their sales and transfers:—

Year	Special Farming and Dairying Societies		Farming and Dairying Departments of Wholesale and Retail Distributive Societies		Total Agricultural Production by all Classes of Societies.	
	No of Socie-ties	Sales	No of Socie-ties	Sales and Transfers *	No of Socie-ties	Sales and Transfers.
		£		£		£
1902 .	193	1,101,611	48	478,534	241	1,580,145
1903 ..	225	1,181,056	52	427,594	277	1,608,650
1904	256	1,232,668	61	401,383	317	1,634,051
1905	260	1,372,552	56	402,639	316	1,775,191
1906	272	1,683,120	61	473,258	333	2,156,378
1907 ...	287	1,829,279	64	477,379	351	2,306,658
1908	302	1,935,822	70†	494,889	372	2,430,711
1909	317	2,005,314	72†	467,967	389	2,473,281
1910 ..	335	2,205,140	72†	435,568	407	2,640,708
1911 ...	337	2,340,287	73†	330,267	410	2,670,554

* The goods produced by the Distributive Societies are not usually sold direct by the productive departments, but are transferred to the distributive departments

† Including the productive department of one distributive agricultural society

As compared with 1902 the value of the produce in 1911 showed an increase of 69 per cent. Societies devoted to farming and dairying showed an increase in sales of 112·4 per cent., while the farming and dairying department of industrial societies showed a decrease of 31

per cent. As compared with 1910, however, the figures for 1911 showed an increase of only 1·1 per cent. in the total production. This is due to a reduction of 24·2 per cent. in the value of the produce of industrial societies, which almost neutralised an increase of 6·1 per cent. in that of special farming and dairying societies.

Cattle and Pig Insurance Societies.—In addition to the co-operative societies engaged in production and distribution in 1911, there were sixty societies registered specially for the mutual insurance of the pigs and cattle belonging to their members.

The following table shows the membership, receipts, expenditure, and funds of these societies for the years 1907–1911:—

	1907	1908	1909	1910	1911
Number of Societies making Returns	56	57	57	60	60
Total Membership ...	3,434	3,499	3,574	3,653	3,623
Receipts during Year:—	£	£	£	£	£
Contributions	1,665	1,641	1,761	1,842	1,818
Other Receipts	454	476	495	507	453
Total Receipts... . ..	2,119	2,117	2,256	2,349	2,271
Expenditure during Year:—					
Benefits to Members	1,539	2,088	1,908	1,757	1,929
Working Expenses	421	364	387	388	258
Total Expenditure ...	1,960	2,452	2,295	2,145	2,187
Total Funds at end of Year	8,091	7,868	7,671	8,108	8,132

Small Holdings and Allotments Societies.—There were also, in 1911, 94 co-operative small holdings and allotments societies, with a total membership of 10,245, as compared with 83 societies and 8,506 members in 1910. Their total capital was £22,968, consisting of £8,497 in shares, £12,071 in loans, and £2,400 in reserve funds.

These societies held 10,857 acres of land, for which £18,751 was payable by them in rent, rates and taxes; 10,614 acres were let to 8,423 tenants, who paid £21,890 to the societies for rent, rates and taxes.

A number of the societies have formed trading departments for the purchase of members' requirements and for the sale of their produce. The total sales of requirements to members were £2,356, and the sales of members' produce were £1,007.

The net result of the operations of the whole of the societies in 1911 was a loss of £209. (*Board of Trade Labour Gazette,* March, 1913.)

Co-operative Credit Associations in the United Kingdom.

At the end of 1911 there were at work 223 co-operative credit associations, with an aggregate membership of 22,054, as compared with 81 associations and 6,014 members in 1901.

In 1911, 45 of these associations with 4,088 members were in England (of which 18 with 3,364 members were urban); one (urban) association with 354 members was in Scotland; and 177 associations (all rural) with 17,612 members were in Ireland.

The amount of loans advanced to members in 1911 was £79,808, and the amount repaid, including interest, £77,623, and each of these figures is about four times as large as the corresponding figure for 1901. The total capital of the associations was £168,274, and the amount owing by borrowers £117,439.

The associations are usually managed by unpaid officials, and the expenses are therefore kept small. Thus the total working expenses, including interest on capital, of the whole of the 223 associations was only £7,919 in 1911. The aggregate net profit made by all the associations was £302. (*Board of Trade Labour Gazette,* March, 1913.)

Bedworth Co-operative Horse Insurance Society.

In 1896 a number of owners of horses at Bedworth and Longford, on the outskirts of Coventry, formed a co-operative society for the insurance of their horses, which was in 1906 registered under the Friendly Societies Act The object of the Society is declared to be "to provide by voluntary subscriptions of the members, with the aid of donations, for insuring money to be paid on the death of a member's horse." At the end of 1912 the Society consisted of 87 members and insured 109 horses, of which 98 were used mainly for hauling coals and other heavy weights, and 11 for light carting work by dairymen, bakers and butchers. The great majority of the horses insured are owned singly by men who make a living by driving coals from the pits to the houses of colliers and customers, some of the men being ex-colliers, disabled by accidents in the pits.

The horses are valued by a veterinary surgeon once a year, in the month of May, when for greater convenience they are collected in a field for his inspection. The value he puts upon them is accepted as the basis on which the premium for the following year is calculated, and as determining the amount to be paid by the Society to the owner of any horse which may die within the year. Should any member fail to produce his horse for valuation at the annual inspection, he is required to take it, as soon as possible thereafter, to the veterinary surgeon and pay 2*s.* 6*d.* as the fee for a special valuation. The age and description of each horse are carefully recorded, together with its value, and no dispute has been known to occur, as regards either the identification of a horse or the amount payable on it.

The value placed last year on the 109 horses came to a total of £2,564, which gives an average of nearly £24 per horse: 43 of the horses were valued at £20 or less, 35 at between £20 and £30, and 31 at over £30. The lowest value placed on any horse was £9, and the highest £42. Of the 95 horses which were valued both in the years 1911 and 1912, 55 showed no change in value, 6 were valued at a higher rate than before, the average increase in value being £4 10*s.*, and 34 were valued at a lower rate than in the previous year, the average decrease in value being £4 15*s*. No horse is accepted for insurance for the first time unless it is passed by the veterinary surgeon as of good market value and as not over 15 years of age, but a horse, once insured, may be kept by its owner on the books of the Society until it is sold or dies. Of the 109 horses under insurance at the end of last year 48 were over 12 years of age.

Whenever an insured horse falls ill or meets with an accident,

the owner is bound to give immediate notice to the veterinary surgeon, who is under an engagement to attend with the least possible delay, either by day or by night. Members are required to let him know at once when signs of illness are noticed and not to rely on their own remedies; but drenches for cases of colic, etc., are kept in readiness and used when necessary, pending his arrival. Should the horse die or be condemned to be slaughtered, the Society pays the owner three-fourths of the value put upon it at the last valuation. The carcass is at the disposal of the Society, which has made a contract for an all-round payment during this year of £1 6s. per carcass.

When a member first enters a horse, he has to pay an entrance fee of 3*s* 6*d*, which covers not only that particular horse, but any other that may take its place The insurance contributions are payable fortnightly, and are charged at the rate of 1*d*. per week for every £5 or part of £5 at which the horse is valued, so that on a horse valued at the average rate of £24, the insurance contribution payable would be 5*d*. a week, that is £1 1s 8*d* a year.

The Society has made a contract with its veterinary surgeon, in accordance with which he not only values the horses, but attends them without any additional fee, and supplies them with medicine free of charge The number of horses annually insured for the last six years gives a total of 742 Of these 48 died or were slaughtered, so that the average annual death-rate was 6 5 per cent, the lowest death-rate in any year having been 4 3 per cent, and the highest 9 5 per cent. On these 48 horses the Society paid £589, which gives an average of £12 6*s* per horse that died, the largest amount paid on any horse was £24, and the smallest amount paid was £5 5s.; so that, as might have been expected, the death-rate was much higher among the older and less valuable horses than among the younger and more valuable animals The 16 horses on which claims had to be paid during the last two years were all over 11 years of age; their average value was only £15, and the average amount paid on them by the Society was £11 5s There used to be no restriction as to the age at which a horse might be accepted for insurance, but now the Society refuses to insure a horse known to be over 15 years of age, unless it is already insured, and the introduction of this restriction partly accounts for the marked decrease in the death-rate last year from 7 6 to 4 6 per cent. and to the consequent large saving of £87 made in that year The amount paid on claims during the six years is equivalent to an average of 16s. per horse insured.

Separate accounts are kept of the insurance and the management funds, and the total amount charged to the insurance fund, including claims and veterinary surgeon's fees, was £764 for the six years The income credited to this fund consisted of £766 realised as insurance contributions, which gives an average of almost exactly £1 per annum per horse insured, £17 from interest, and £12 from sale of carcasses, making the total income of the insurance fund £796 This would have left the insurance fund with a gain during the six years of £32, but during the last three years £60 have been transferred to this fund from the management fund account, so that, as it now stands, the insurance fund shows a gain on the six years of £92, having increased from £136 to £228.

The expenses charged to the management fund amounted for the six years to £116, of which £73 was paid in salaries, the principal item being £10 a year paid to the Secretary; £8 was paid as rent for rooms for meetings, and the remainder for printing, stationery, and miscellaneous charges. The cost of administration, apart from the veterinary surgeon's fee, thus averaged 3*s.* 2*d.* per horse insured. To meet these expenses the members paid a management contribution of 1*s.* per quarter per horse insured, the total income from this source being £117 There were also credited to this fund entrance fees, subscriptions of honorary members (about £24), and fines. The Society is strict in exacting fines, not only for unpunctuality in payment of contributions, but for absence from the quarterly meetings, no excuse being accepted except that of ill-health. The total income of the management fund during the six years amounted to £203, so that this fund showed a surplus during that period of £87; but, as already said, £60 has been transferred from the management fund to the insurance fund, and the accounts show the management fund as having increased during the five years from £45 to £72 Putting together the surpluses at the credit of the two funds, the Society at the end of the year 1912 possessed altogether £300, which was deposited in the Savings Bank. This gross surplus had increased to that figure during the six years from £181, so that, taken altogether, the Society's finances are in a sound condition, and it now possesses a reserve fund equal in itself to more than three times the average annual loss on claims of the last six years.

The owner of a horse of the average value of £24, on which, if it dies, he will receive £18 from the Society, thus pays an insurance contribution of £1 1*s.* 8*d.* per annum and a management contribution of 4*s* per annum, making a total payment of £1 5*s* 8*d.* per annum, in return for which he not only has his horse insured, but obtains free of charge veterinary attendance and medicine in case his horse should fall ill. This privilege may be reckoned as an ample return for his management contribution, and the amount he actually pays for insurance risk may be taken as £1 1*s.* 8*d.*, which comes to about 6 per cent. on £18, the amount he would receive if his horse were to die. On the average the insurance contribution comes to about 6½ per cent. on the amount payable on the death of a horse

This may be compared with the rates charged by live-stock insurance companies for the insurance of heavy-draught horses of the class to which most of the Bedworth horses belong. The usual rate charged on this class of horse by such companies is from 7½ to 10 per cent. on the amount payable in case of death, *plus* 3 per cent to cover the risk of death from fire or lightning; so that, while a member of the Bedworth Society owning a horse worth £24, used for hauling coals, on which in the case of its death he would receive from the Society £18, can insure it with the Society on payment of an insurance premium of £1 1*s.* 8*d.* per annum, he would, if he insured it with an insurance company for a payment of £18, have to pay from £1 7*s.* to £1 17*s.* per annum Moreover, these insurance companies generally charge a higher premium on any animal over ten years of age, and refuse to commence insuring horses over 12 or 13 years of age, whereas the Bedworth Society insures horses at the same premium whatever

their age be, and accepts new horses for insurance up to 15 years of age. A member of the Bedworth Society also receives the advantages of veterinary medicine and attendance free for his horse, whenever it falls sick, on a payment to the Society of 4*s*. a year, and his Society holds savings amounting to £300, which offer him good security against the risk of having to pay a levy to make up for a possible deficiency in the insurance fund.

The Society has been very successful and of great benefit to the small horse-owners of whom it is composed.

Friskney Cow Insurance Society.

Friskney is a large rural parish in Lincolnshire, on the shores of the Wash, between Boston and Skegness. Its total area under crops and grass is over 6,000 acres, of which about 1,600 are under permanent grass, 2,500 under corn crops, and 1,500 under potatoes and roots According to the returns for 1911, about 78 per cent. of the total number of agricultural holdings above one acre were under 50 acres, so that it is a district of small holders. There were in the parish about 1,250 cattle, of which some 330 were cows or heifers in milk or in calf.

In 1853 the owners of cows started a Society, called "The Farmers', Tradesmen's and Cottagers' United Cow Club," with the object of raising funds "for insuring sums of money to be paid to the members at the death of such cow or cows as may be entered on the Society's books." The Society now consists of seventy members, residing within a radius of twelve miles Most of them own small holdings of not more than twenty acres. There is no limit to the number of cows a member may insure, but only one member has insured as many as five cows, and most of the members insure only one cow each. At the end of 1911 the total number of cows insured was 104, which gives an average of 1 5 cow per member. Only cows over two years of age are accepted for insurance, but there is no limit of age beyond which a cow ceases to be insurable. When a cow falls ill or meets with an accident, she is valued by three of the committee, and if she dies the owner is paid three-fourths of her value, whatever it be, and the carcass is sold for the benefit of the Club The four cows that died in 1911 were valued at from £12 to £22 10*s* ; the amount paid to the owner varied from £9 to £16 17*s* 6*d*. Their average value was £17 4*s*., and the average amount paid by the Club per cow was £12 18*s*. During the last ten years the Club has paid on 42 cows an average amount of £12 8*s*., which gives the average value per cow that died as £16 10*s*.

A new member must be approved by a general meeting, and each member has to pay an entrance fee of 7*s*. 6*d*. for each cow he insures, and 6*d*. per month (*i.e.*, at the rate of 6*s*. per annum) as premium contribution for each cow. He is also liable to a special levy under a rule which provides that "if at any time the funds of the Society shall be below 7*s*. 6*d*. for each cow entered, an assessment shall be made upon the owners thereof, to keep the funds up to the aforesaid sum."

In the last ten years the Club insured on the average 105 cows

every year and lost 42 cows altogether, which gives a death-rate of 4 per cent. per annum; in the best year it lost only two cows, and in the worst year eight, which gave for the latter year the high death-rate of 7·1 per cent. The amount paid on claims averaged £52 2*s*. 4*d*. per annum, which equalled an average of nearly 10*s*. per cow insured. The premium income averaged only £31 4*s*. 11*d*. per annum, or 6*s*. per cow insured, not nearly enough to meet the losses. There was other income for the insurance fund, including an average per annum of £3 3*s*. 1*d*. from sale of carcasses (about 15*s*. per carcass), but it became necessary, in no fewer than seven of the ten years, to make a special levy of 2*s*. per cow insured, in order to maintain the insurance fund at the desired amount. This gave an average income per annum from levies of £7 5*s*. 5*d*., and brought up the total average income of the insurance fund to £45 2*s*. 11*d*. But, as the average losses amounted to £52 2*s*. 4*d*., there was still an average annual deficiency of £7, which was met by drawing on the reserve fund; so that that fund, which at the beginning of the ten years amounted to £137, now stands at only £67.

The costs of management are met mainly from a separate contribution of 6*d*. per annum per cow insured, which brought in, on the average, £2 13*s*. 1*d*. per annum. The total cost of management averaged £3, which includes a salary of £1 paid to the marker, and of 15*s*. paid to the secretary, and £1 for rent. The affairs of the Club are administered by a president, three trustees, a treasurer, a secretary, and a committee of twelve members, including office-bearers, all elected annually by a general meeting of the Society. The duties of the marker are especially responsible, as he has to pass as sound and mark all cows offered for insurance (for this he receives from the owner 3*d* per cow, if in the parish of Friskney, and 6*d*. per cow if outside the parish), while he also has to visit any cow that falls ill and see that the owner uses all possible means for its recovery.

Thus, on the average of the last ten years, the members of this Friskney Cow Insurance Society have paid in premiums, levies, entrance fees and management contribution altogether 8*s*. per cow per annum In return for this payment they have been able to insure their cows against death from disease or accident up to three-fourths of the value of each cow, without limit as to total value.

One reason why the Friskney losses are so high as compared with other cow clubs is that there is no maximum limit to the amount payable on the death of a cow. Some of the most successful clubs elsewhere have a rule that they will not pay more than £10 or £12 on any animal, and in 1910 in seventeen Societies the average paid per animal (including calves) was only £8 15*s*., while the Friskney average paid is £12 8*s*.

Agricultural Co-operation in Germany.

According to the report for 1911–12 of the *Reichsverband der deutschen landwirtschaftlichen Genossenschaften* there were in Germany on June 1st, 1912, 26,026 agricultural co-operative societies, with a membership of 2,430,000. The progress of agricultural co-operation in Germany during the last twenty-two years is seen in the following table.

Date	Credit Societies	Trading Societies	Dairy Societies	Other Societies.	Total.
	No	No	No	No	No
1890	1,729	537	639	101	3,006
1895	4 872	869	1,222	207	7,170
1900	9,793	1,115	1,917	811	13,636
1905	13,181	1,867	2,832	1,443	19,323
1910	15,517	2,280	3,333	2,715	23,845
1911	15,990	2,346	3,415	2,973	24,724
1912	16,774	2,417	3,475	3,360	26,026

The important progress made in 1911–12 is stated to be due chiefly to the serious losses to German agriculture in 1911 through drought and cattle disease, farmers learning to appreciate the benefits of co-operation in years of calamity. A noteworthy feature in 1911–12 was the formation of 252 societies for the employment and distribution of electrical energy

On June 1st, 1912, there were 20,435 societies affiliated to the Imperial Federation (*Reichsverband der deutschen landw Genossenschaften*), 77 being co-operative central societies, 13,606 credit societies, 2,241 trading societies, 2,193 dairy societies, and 2,318 miscellaneous societies. At the end of 1911 the capital of 36 central credit societies was £2,300,000, the amount deposited by local credit societies with the central societies was £15,500,000, and the amount borrowed by the local societies from the central societies was £15,100,000 As a result of the bad season of 1911 the amount deposited by the local societies was less, and the amount borrowed was greater, than in the previous year This caused some of the central banks to raise their rate of interest

Local Credit Societies.—The importance to which agricultural co-operative credit has attained in Germany is shown by the record of the work of the local credit societies in 1910 The total number of such societies in existence in that year was 16,735; they had a working capital of £135,000,000, of which £120,000,000 were members' deposits; at the end of the year the loans on current account were £23,000,000, and for fixed periods £60,000,000; the total amounts of the loans granted in 1910 were £34,000,000 on current account, and £15,000,000 for fixed periods Many of these local credit societies undertake the purchase of farm requisites for their members, the purchases in 1910 amounting to £4,300,000

Co-operative Dairy Societies—Reports were received in 1910 by the Imperial Federation from 2,033 dairy societies with 213,732 members, 1,869 societies made returns as to the amount of milk received during the year, *viz.*, 46,300,000 cwt , or 25,000 cwt per society The sale by the societies of the milk as fresh milk is a branch of their work which is rapidly increasing in importance The amount so sold in 1910 was 7 1 per cent. of the milk received, and the production of butter by the societies decreased as compared with the previous year, principally as a result of the increased sale of fresh milk The members were paid on an average 5 3*d*. per gallon of milk supplied, the fresh milk and dairy produce sold was at the rate of 6*d* per gallon of milk supplied. Some of the dairies return the separated milk to the members free of charge.

The working capital was £4,300,000, or £2,200 per dairy: 296 societies made neither profit nor loss, 1,505 made total profits of £310,000 (or £200 per dairy), and 184 made a loss of £25,000 (or £140 per dairy).

Co-operative Trading Societies.—The statistics of local co-operative purchase and sale societies for 1910 refer to 2,120 societies with 241,022 members. The value of the goods bought was £5,900,000, and of agricultural produce sold £3,000,000 (*Bull. Bur. Econ. and Soc. Int.*, Nov., 1912.)

Report on Agricultural Credit and Agricultural Co-operation in Germany.

A report by Mr. J. R. Cahill to the Board of Agriculture and Fisheries of an inquiry into agricultural credit and agricultural co-operation in Germany, with some notes on German live-stock insurance, has been published as a blue book (Cd. 6,626, price 5*s.*, Wyman and Sons).

Mr. Cahill states, in a prefatory note, that in no modern State does organised effort for safeguarding and promoting the economic interests of agriculture appear to have been so persistent and so successful as in Germany, more especially in the direction of providing the farmer with facilities for obtaining credit, for acquiring the instruments of production, and for disposing of his produce on the most favourable terms. In the present Report an endeavour has been made to set out in considerable detail the principles and practice, together with the results of the working, of the three groups of organisations that owe their existence to this organised effort in German agriculture The Report is based essentially upon knowledge obtained by personal inquiry and upon the study of original documents A general report on agricultural credit, agricultural co-operation and live-stock insurance in Germany of some thirty pages, is followed by a detailed report on the same subjects of 302 pages in length, while in a valuable appendix to the report are given translations of laws and documents, maps, and a very complete bibliography.

The hope is expressed that the volume may prove to be a source from which those interested in schemes for building up the economic and social structure of rural life in this country may, without too much trouble, be able to obtain an abundant supply of serviceable material.

It is stated by Mr Cahill that the great system of German rural co-operative credit, as we now see it, has not been created in a day, and it is hardly to be expected that the work of establishing a similar system would progress more rapidly in England. On the other hand, there seems to be no reason why it should progress more slowly in this country than in Germany, especially if a similar intensive and penetrating propaganda could be set in operation. Only through such local organisations would it seem possible to establish the close contact that must exist between lender and borrower, if small farmers are to be in a position to obtain credit on suitable terms.

OFFICIAL NOTICES AND CIRCULARS

The Board have addressed the following circular letter dated March 27th, 1913, to the Local Education Authorities in England as to agricultural education in connection with Farm Schools and Farm Institutes:—

Agricultural Education in Connection with Farm Schools and Farm Institutes.

SIR,—I am directed by the Board of Agriculture and Fisheries to transmit for the information of your Authority a copy of a Memorandum * (A 249/I) setting out the arrangements which have been agreed upon between the Board and the Development Commissioners in connection with the grant which has been made for the period ending March 31st, 1916, for the purpose of extending and systematising agricultural education in England and Wales

2. In recommending the Treasury to make this grant to the Board, the Development Commissioners intimated that they wish to provide further opportunities of instruction in agricultural subjects, and especially to increase the number of Farm Schools, at which short courses suitable for the sons and daughters of farmers and others can be held, and of Farm Institutes, which will serve as headquarters for the County Agricultural Staff The Development Commissioners have stipulated that the grant may only be used to aid new and additional work, and the Board are therefore precluded from using this grant from the Development Fund in aiding the existing expenditure of Local Education Authorities.

3 The maximum grant towards the annual expenditure which the Commissioners have felt themselves able to sanction varies, in different counties, from 50 per cent. to 75 per cent, in proportion to the financial burden hitherto undertaken by the Local Authorities; the object being that those counties which are already incurring considerable expenditure should be aided at a higher rate than those counties where the present expenditure is small. In addition a capital grant will be made towards the cost of land, buildings and equipment for schools and institutes. A very considerable portion of the expense will in this way be provided from the Development Fund, and your Authority will, no doubt, recognise that these grants are at a considerably higher rate than any other ordinary grants for educational purposes

Agricultural Education Committees.

4 The Board would invite the attention of your Authority to paragraph 4 of the Memorandum, in which it is proposed that the whole of the county work of agricultural education should be under the direction of a Committee, which may be an Agricultural Sub-Committee of the Education Committee, an Agricultural Education Committee of the County Council or a Committee appointed jointly by a group of counties Any one of these three types of Committee will secure the object the Board have in view, viz., the separate consideration of the needs of the county as regards agricultural education, and, in the event of the present arrangements in your county

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* See p 65.

not achieving that object, the Board trust that your Authority will, at an early date, take steps to form a Committee to deal solely with agricultural education. As pointed out in the Memorandum, the members of this Committee should be selected so as to include a sufficient number of local agriculturists or other persons directly interested in agriculture and its allied industries.

Appointment of Organisers of Agricultural Education.

5. In order to facilitate the work of this Committee, the Board think that a special officer should be appointed who would be able to organise and supervise the work done in the county and advise the Committee as to the steps to be taken to extend and improve it It may in some cases be desirable that this officer should act as secretary to the Committee, though it is important that he should not be burdened with secretarial duties which would in any way interfere with his main function The organiser should himself give instruction in some branch of agriculture, and he would be expected to give advice on ordinary agricultural questions, and endeavour to keep in touch with all sections of the farming community. He would usually act as principal of the Farm Institute, and would be the head of the County Staff of Instructors supervising all branches of agricultural education undertaken by the Committee

6 It would also be necessary that the organiser should keep in close touch with the work of the Agricultural College with which the county is connected, with the special object of bringing to the notice of the staff of the college difficulties experienced by farmers in the neighbourhood in regard to which advice is required. For this purpose it may be desirable that he should be attached to the college as an honorary, or ordinary, member of the staff.

7. The salary attaching to the post would vary with the qualifications and experience of the officer to be appointed, but the Board suggest that it should be sufficient to attract and retain the services of a fully qualified man likely to command the respect and confidence of agriculturists.

8. In some counties officers of the type described above have already been appointed, and in some others special arrangements may be desirable, but the Board would ask your Authority to give careful consideration to the question, as in their opinion the appointment of an organiser, for the purposes indicated above, is essential if agriculturists are to secure the full benefits of the grants now placed at their disposal by the Government.

Schemes of Agricultural Education.

9. The allocation of these new grants makes the present time very opportune for a general review of the whole circumstances of agricultural education in each county, and, with this object in view, it is proposed, in paragraph 5 of the Memorandum, that a scheme should be prepared, providing for the systematic organisation of all agricultural education within the area. In many counties such a scheme is already in existence, but it will be desirable that this existing scheme should be carefully considered with a view to its extension and modification

in such a way as to bring it into harmony with the purposes for which the Farm Institute grant is made. Much importance is attached to the suggestion that the scheme should provide for all stages of agricultural education above the elementary or secondary school level, so that a definite connection may be established between the itinerant instruction on the one hand and the Farm School on the other, and also between the Farm School and the Collegiate Centre.

10. Any such general consideration of the needs of agricultural education must necessarily be a matter of some difficulty, more especially in view of the desirability of co-ordinating the work of neighbouring counties and bringing them into closer relation with one another and with the Agricultural Colleges, and it was with the object of aiding Local Authorities in this matter that the Board proposed the establishment of Advisory Councils. These have now been formed in almost all parts of England, and a separate Agricultural Council has been established for Wales The Board hope that these Councils will be able to give considerable assistance to Local Authorities, more especially with regard to the points mentioned in paragraph 3 of the Memorandum.

11 It will be observed that the scheme should provide for the direct connection of the agricultural education of the district with a Collegiate Centre or Farm School, and that the Institution selected should serve as the headquarters of the lecturers and instructors, the existence of such headquarters being regarded as an essential factor in any scheme It is recognised, however, that local circumstances vary considerably in different districts, and the Board have no desire to prescribe in any definite manner the precise type of school or institute to be adopted in each district, but it must be such as to provide organised short courses of instruction suitable to the conditions of the district.

Applications for Grants.

12. As a full and complete consideration of the subject must necessarily take time, the Board, in order to avoid delay, will be prepared, pending the preparation of a scheme, to approve suitable forms of new and additional work with a view to the payment of a grant in respect of any of the purposes mentioned in paragraph 10 of the Memorandum. If, therefore, your Authority is prepared to undertake any new work or any extension of existing work during the ensuing financial year (1913-14), I am to ask you to furnish particulars on Form 47/E *.

13 It will be observed also from paragraphs 11 and 12 of the Memorandum A 249/I that a statement will be required, in connection with the payment of the grant, of the receipts and expenditure of the Local Authority on agricultural education in the three years ending March 31st, 1912, and the Board would be glad if your Authority would arrange for this statement to be supplied to them (on Form 42/E) * with as little delay as possible, should they propose applying for a grant from this fund

14. I am also to enclose a statement (A 257/I *) of the particulars

* Not printed.

which it will be necessary to supply in making application for capital grants for Farm Schools or Farm Institutes.

15. In conclusion, I am to say that the Board will be happy, through their Inspectors, to render assistance in the preparation of new schemes or the extension of existing ones, and they desire me to express a hope that your Authority will see their way to co-operate with them in securing a substantial improvement in the provision of agricultural education.

I am, etc.,
SYDNEY OLIVIER,
Secretary.

The following is a copy of the Memorandum (A249/I) referred to on p. 62.

1. The Board of Agriculture and Fisheries will be prepared to make grants from money placed at their disposal by the Treasury from the Development Fund for the purpose of aiding Local Authorities in England and Wales to extend and systematise agricultural education in their districts. These grants will be in the form of—

(*a*) Contributions towards the expenses of the Advisory Councils which it is proposed to set up;

(*b*) Contributions towards the cost of providing and maintaining buildings and land for Farm Schools and Farm Institutes;

(*c*) Annual contributions towards the cost of new and additional work at, or in connection with, Farm Schools and Farm Institutes.

Advisory Councils.

2. The Board will invite Local Education Authorities and the Governing Bodies of Centres for Higher Agricultural Education to form Advisory Councils in such areas or provinces in England as may be decided upon, and to nominate representatives thereon. In order to secure the representation on the Council of all agricultural interests, the Board will also nominate members. The Council, when formed, will appoint its own Chairman and Vice-Chairman.

3 The Council will be asked:—

(*a*) To consider the needs of the area or province as a whole in regard to agricultural education, and the schemes prepared in respect of the several counties or groups of counties, and to advise the Local Education Authorities thereon, with a view to maintaining a close connection between schemes for providing agricultural education in the counties and the work of the approved centre or centres for higher agricultural instruction in the area or province;

(*b*) To advise as to the co-ordination of the provision of technical advice for farmers, both through the medium of the Centre for Higher Agricultural Education and through the agricultural staffs of the counties;

(*c*) To assist in the preparation of schemes of agricultural experiments and demonstrations to be carried out jointly by the counties within the area or province;

(*d*) To assist Local Education Authorities in obtaining such part-

time instructors as they may require in order to enable such instructors to be wholly and exclusively employed within the province;

(e) To advise Local Education Authorities as to the need for further Farm Schools and Institutes as centres for agricultural education of a less advanced type than that provided at the Centre for Higher Education

(f) To report to the Board on the state of agricultural education in the area or province, with special reference to the above points.

Agricultural Education Committees.

4. In each county the whole of the county work of agricultural education should be under the direction of a Committee, which may be the Agricultural Sub-Committee of the Education Committee, the Agricultural Education Committee of the County Council, or a Committee appointed jointly by a group of counties. In order to gain the confidence of the farming classes, the Committee should include a sufficient number of local agriculturists or other persons directly interested in agriculture and its allied industries. The Committee should be represented on the Advisory Council.

The Committee should appoint a special officer to act as organiser of the work of agricultural education This officer should be required to give instruction in one or other of the branches of agriculture, and his qualifications should be submitted to the Board of Agriculture and Fisheries for their observations, before any appointment is made

Schemes of Agricultural Education.

5 In each county or group of counties applying for a grant there should be prepared, by the Committee specified in paragraph 4, a scheme for agricultural education in the area, including all the work carried on or proposed to be carried on in respect of which application for a grant is made Such scheme should provide for the systematic organisation of all agricultural education within the area, and for its direct connection with a Collegiate Institution or Farm School, which should be the headquarters of the itinerant lecturers and instructors employed

Farm Schools and Farm Institutes.

6. A Farm School may be defined as an institution providing

(i) Winter short courses in agriculture suitable for those who have acquired some practical experience on the land since leaving elementary schools :

(ii) Summer short courses in agriculture where these are required by the circumstances of the district.

A Farm Institute may be defined as an institution which, in addition to providing courses of instruction of a type suitable to the conditions of the district, also serves as a headquarters for Instructors in agricultural subjects employed by a county or by a group of counties A Farm Institute may be part of, or located at the same place as, a Collegiate Institution

Unless in the opinion of the Board the circumstances are such as to warrant exceptional treatment, a suitable headquarters for whole-

time itinerant Instructors will be regarded as an indispensable element in any scheme of agricultural education for a county or group of counties.

7. A Farm School or Farm Institute must be under the control of the Local Education Authority, or of a body on which one or more Local Education Authorities and also persons interested in rural life are represented, to whom in exceptional cases grants may be made.

8. The premises of a Farm School or Farm Institute must be suitable for teaching purposes, and the equipment of the class-rooms or laboratories provided must be sufficient for the instruction to be given therein.

9 In considering any application for a grant either for the establishment or the maintenance of a Farm School or Farm Institute, the Board will have regard (i) to the report of the Advisory Council on the existing supply, either in the same or adjoining counties, of educational facilities similar to those to be given in the school or institute, (ii) to the proposed relation of the school or institute to a Centre for Higher Agricultural Education; and (iii) to the needs and conditions of the rural industries of the locality.

Conditions of Grant.

10 The Board will be prepared to make grants in respect of new and additional work undertaken in accordance with an approved scheme prepared as indicated in paragraph 5, or, pending the preparation of such a scheme, in respect of such new and additional work as may be approved by the Board.

The purposes for which grants may be made are as follows:—

(*a*) The provision of a County Staff of Agricultural Instructors;

(*b*) The provision and maintenance of a Farm School or Farm Institute;

(*c*) The provision of regular short courses of instruction at an approved centre,

(*d*) The provision of local courses of lectures and practical demonstrations, including the provision of other forms of miscellaneous instruction and advice through the agency of the County Agricultural Staff, or otherwise;

(*e*) The payment of the administrative expenses of the Advisory Council and of the Committee referred to in paragraph 4.

11. Grants must be used for the development and extension of the work of agricultural education, and not for the purpose of effecting a reduction in the annual charges previously incurred by a Local Authority on work of that type. For the purpose of this paragraph the average expenditure by a Local Authority in the three years ending March 31st, 1912, will be taken as a standard. The decision as to the amount to be taken as the expenditure on agricultural education for the purpose of this paragraph will rest with the Board.

In making application for a grant for the first time a statement signed by the County Treasurer and countersigned by the Clerk of the Council or other authorised officer must be supplied, showing in detail the receipts and expenditure incurred by the Local Authority in respect of agricultural education during the three years ending March 31st, 1912.

12. The grant to be paid will be determined on a consideration of the cost and efficiency of the agricultural education provided under an approved scheme, but the maximum grant payable will not exceed a fixed proportion of the excess expenditure over and above the average expenditure incurred in the three years ending March 31st, 1912.

In fixing this proportion, which will vary in different counties from 50 to 75 per cent., the Board will have regard to the financial burden hitherto undertaken by each Local Authority for the purpose of agricultural education.

13. In the case of the provision, improvement, or extension of a Farm School or Farm Institute the grant payable by the Board will not exceed 75 per cent. of the total approved cost, including cost of equipment. For the purpose of this grant, the Board will consult the Advisory Council for the area or province, and will not contribute to any expenditure for which the Board's approval has not previously been obtained, or which in the opinion of the Board is excessive or unnecessary. In no case will the Board contribute to the cost of providing or maintaining for use as a farm an area exceeding 20 acres, except in accordance with paragraph 14

14 Where a Local Education Authority desires to use or provide for use as a farm in connection with a Farm School or Farm Institute an area exceeding 20 acres, the Authority may submit a full explanation of the circumstances to the Board, and if the Board and the Development Commissioners are satisfied that the use or provision of the proposed area is desirable for the efficient working of the Farm School or Farm Institute, the Local Education Authority may receive a grant under and in accordance with these conditions for the cost of the maintenance of the farm, and in ascertaining such cost the following payments may be included, viz --

(*a*) Where the land is purchased by the Authority, the payments necessary for interest on the cost of purchase and for a 40 years' sinking fund for its repayment;

(*b*) Where the land is leased by the Authority, the cost of acquisition and the rent;

(*c*) The payments necessary for interest on the cost of approved buildings and improvements and repairs of a permanent character, and for a (maximum) 20 years' sinking fund for its repayment;

(*d*) Payments at not more than 5 per cent by way of interest on farming capital; and

(*e*) All usual and proper costs of management, including rates, taxes, and tithe rent charges and other outgoings.

15. No grant will be made in respect of the acquisition of land as a site for the erection of a Farm School or Farm Institute unless the land is of freehold or long leasehold tenure. Where land is acquired partly for such purpose and partly for a farm to be used in connection with the Farm School or Farm Institute or for any other purpose, the apportionment of the cost of acquisition between the several portions shall be subject to the approval of the Board

16 Every grant towards the cost of the acquisition, erection, and permanent improvement of any land or building shall be made on the condition that in the event of the sale of the premises the proportion of the proceeds fairly attributable to the grant shall be paid to the

Board, the amount in default of agreement to be determined by the Board.

17. A statement of the income and expenditure in respect of any land used for the purpose of a farm in connection with a Farm School or Farm Institute must be rendered separately from the general statement of expenditure on agricultural education, so as to show the profits or losses consequent on the occupation of a farm, as distinct from the cost of the teaching and educational facilities provided in connection therewith.

18. No grant will be payable in respect of any instruction given at an elementary or a secondary school or at a rural evening school, unless such rural evening school is one for students over 16 or 17, in which the instruction provided is chiefly in technical agricultural subjects.

19. For the purposes of this Memorandum the expression "agriculture" includes horticulture, forestry, and related rural industries, and the expression "agricultural" has a similar meaning.

The Board have addressed the following circular letter, dated March 25th, 1913, to Local Authorities in Great Britain under the Diseases of Animals Acts, 1894 to 1911 —

Tuberculosis Order of 1913.

SIR,—I am directed by the Board of Agriculture and Fisheries to refer to paragraph 16 of their circular letter of the 17th ultimo,* on the subject of the Tuberculosis Order of 1913, and to draw the attention of your Local Authority to the following points connected with the administration of the Order.

Reports of Disease and Veterinary Inquiry.

2 The Local Authority may be set in motion (*a*) by receiving notice of suspected disease from the owner of an animal, or by other information relating to an animal kept on private premises; (*b*) by the discovery of a diseased animal in a market; (*c*) by the discovery of tubercle bacilli in a consignment of milk from a particular dairy; (*d*) or by receipt of a notice from a veterinary surgeon in conformity with the requirements of Article 3.

3. Where the report has been received in respect of a particular animal, the examination conducted by the Veterinary Inspector should not be confined to the animal which was the subject of the report, but should be extended to other bovine animals on the premises, and particularly to all milch cows, and the Veterinary Inspector should make an exhaustive clinical examination of any animal there is reason to suspect of suffering from tuberculosis of the udder, from tuberculosis with emaciation, or of giving tuberculous milk. Since the Local Authority will be liable to pay full compensation for any animal slaughtered by them as regards which the post-mortem examination does not show that it was affected with tuberculosis, they should be careful to see that in all cases every available test has been made use of before their final decision is reached as regards a particular animal. To this end they should issue instructions to their Veterinary

* *Journal*, March, 1913, p. 1043.

Inspectors that (*a*) in the case of cows suspected of having tuberculosis of the udder or giving tuberculous milk, samples of their milk should be centrifugalised and examined for tubercle bacilli with the microscope; (*b*) in the case of animals suspected on account of an abnormal discharge, the latter should be examined microscopically for tubercle bacilli; and (*c*) in the case of animals suspected to be suffering from tuberculosis with emaciation, but which are not suspected to be suffering from tuberculosis of the udder or to be giving tuberculous milk, all possible use should be made of tuberculin under Article 4 (1) of the Order. In the event of a diseased animal being found in a market, fair ground or sale yard, the veterinary inquiry should be extended to the animals on the premises whence the diseased animal was taken to the market, etc In order that this may be done, the Local Authority in whose district the market, etc , is situated, should, where necessary, communicate with any other Local Authority concerned.

4 Should suspicion first be aroused by the discovery of tubercle bacilli in milk from a dairy the inquiry of the Veterinary Inspector should be directed to the discovery of the particular cow in the herd giving tuberculous milk.

5. It is of importance that the decision of the Local Authority should be come to without avoidable delay in view of the restrictions imposed by Articles 9 and 10 of the Order during the time that an animal remains under suspicion, particularly as regards dairy cows It is suggested, therefore, that the Local Authority should make special arrangements for dealing with the reports received from their Veterinary Inspectors, and the issue of the necessary notification to the owner of the animal.

Valuation, Slaughter, and Post-Mortem Examination

6 The Local Authority are required by Article 5 of the Order to give a notice in writing, in the form set forth in the Schedule to the Order, to the owner of any animal of the fact that such animal has been found by them to be diseased within the meaning of the Order, and to send a copy of such notice to the Board It is intended that a separate notice shall be served as regards each animal So soon as this notice has been issued, arrangements must be made for the slaughter of each animal found by the Local Authority to be diseased, and in this connection the special attention of any valuer employed should be called beforehand to the provisions of Article 6 of the Order.

7. Slaughter may not be proceeded with in the face of written objection by the owner of the animal without the special authority of the Board, and such authority will not be given in respect of any animal valued under the Order at more than thirty pounds provided that the owner of the animal continues to observe the special requirements imposed in such circumstances In no case is an animal valued at more than thirty pounds to be slaughtered except under the directions of the Board

8. With a view of securing to the Local Authority the maximum amount of salvage as a set-off against the compensation they are required to pay under Article 8 of the Order, it will be advisable in the case of animals apparently in good condition that the animal should be removed under supervision to a slaughter-house or some other place

where the carcase can be conveniently dressed for food, and that the post-mortem examination of the carcase by the Veterinary Inspector or veterinary surgeon, required by Article 7 of the Order, should there take place.

Records by Local Authorities and Returns.

9. It is particularly requested that the requirement that a copy of each notice given by the Local Authority to the owner of the animal under Article 5 (1) of the Order shall be sent to the Board, shall in every case be carefully observed, inasmuch as the accuracy of the Board's statistical records will be in a large measure dependent upon such notification. The Board will also be obliged if, in this connection, the Local Authority will be careful to see that the specific form of the disease from which each animal is found to be suffering, is clearly stated in the notice The copy notice should be addressed to *The Secretary, Board of Agriculture and Fisheries, 3 St. James's Square, London, S.W.*

10. The Board think it of importance that accurate records should also be kept locally of the operations against the disease undertaken in the district of each Local Authority, and in addition to the information supplied to them in the copies of notices above referred to they require each Local Authority to furnish them with a quarterly return The return should follow precisely the specimen Return A enclosed* herewith They think it probable that they may also require from time to time more detailed information as to particular cases They suggest, therefore, for the consideration of your Local Authority, that their records might conveniently be kept, and that reports to your Local Authority by their Veterinary Inspectors might be made, in the forms shown in the other enclosures * to this letter, which have been drawn out in such a manner as to facilitate the rendering to the Board of the quarterly return above referred to The Board would also be obliged if your Local Authority would give directions that their records should be open to the Inspectors of the Board engaged in supervising the operations under the Diseases of Animals Acts

All forms used for the purposes of the Order—whether for making returns to the Board or otherwise—must be supplied by Local Authorities themselves

11. It is hoped that if the procedure above set out is followed generally by Local Authorities throughout the country, the effective administration of the Order may be secured with a minimum of trouble and expense to the Local Authorities concerned, whilst the information tabulated will provide statistical evidence which may prove useful in connection with any further operations which may be undertaken against the disease

Suspicious Animals in Markets.

12 Provision is made in Article 11 of the Order for dealing with suspicious animals exposed in markets, fairs, or sales A strict enforcement of the provisions of this Article seems to be very desirable, and the Board trust that Local Authorities will not fail to make arrange-

* Not here printed.

ments for the presence of a Veterinary Inspector at markets, fairs, and sales held within their district in order that the practice of exposing emaciated animals for sale may be discouraged. A useful stimulus will thereby be given to reporting, since the exposure of such animals in a market when in an advanced state of disease would be attended with risk to their owner, who would be liable to legal proceedings for failure to report the case in accordance with the provisions of the Order.

Repayment to Local Authorities of One-half of Compensation.

13. The Lords Commissioners of His Majesty's Treasury have authorised the Board to repay, during a period of five years from the coming into operation of the Order, one-half of the net amounts paid under the provisions of the Order as compensation for slaughtered animals.

The Board will accordingly be prepared to consider in due course any claim which your Local Authority may have to render in respect of expenditure incurred for this purpose.

Claims should be made quarterly for the periods ending on the last day of March, June, September, and December in each year, and should be forwarded to the Board as soon as possible after the close of each quarter.

Any sums received by the Local Authority from the sale of the carcases or parts of carcases of slaughtered animals should be shown in the account and deducted from the total expenditure

Specimen forms of account—B and C—for this purpose are enclosed herewith * The Board would be glad if your Local Authority would render accounts under the Order in the manner indicated in these forms

Publication of Order.

14. The Board would now be glad if your Local Authority would take the necessary steps for the publication of the Order in their district in conformity with the terms of the accompanying Publication notice (A 29/a) *

I am, etc.,

SYDNEY OLIVIER,
Secretary.

Produce of Crops in England and Wales in 1912.

The Board have recently published Part II of the Agricultural Statistics for 1912, relating to the returns of produce of crops in England and Wales in 1912, with summaries for the United Kingdom [Cd. 6636, price 3½*d*]. Tables are given in the Report showing the acreage, produce, and yield per acre of the principal crops in each year from 1897 to 1912, and (for 1912 only) for each county of England and Wales. The tables are prefaced by a report by Mr. R. H. Rew on the duration of the harvest, the yield, the weight of grain crops, and the hypothetical value of crops in 1912.

* Not here printed

MISCELLANEOUS NOTES.

Importation Regulations.

Importation of Plants into South Australia.—A proclamation of January 4th, 1913, under the Quarantine Act of 1908 prohibits the importation into South Australia of any plant grown in soil:—

1. From any country, unless it is previously thoroughly cleansed of soil; provided that the Chief Quarantine Officer for Plants may admit any plant growing in a pot or similar receptacle, if in his opinion the admission thereof will entail no danger of introducing the disease, *Phylloxera vastatrix*.

2. From any country where the disease *Phylloxera vastatrix* is known to exist, unless it is accompanied by a declaration made by the grower before, and countersigned by, a responsible officer of the Department of Agriculture in the country of origin to the effect—

(*a*) That the plant was grown at a greater distance than five miles from any grape vine or root thereof; and

(*b*) That no *Phylloxera vastatrix* exists, or has existed, in or on any land within five miles of the area in which the plant has been growing. (*Board of Trade Journal,* March 6th, 1913.)

Importation of Potatoes into Guernsey.—By an Ordinance of January 20th, 1913, the importation of potatoes from the United Kingdom into Guernsey is prohibited, unless each consignment is accompanied (*a*) by a declaration from the shipper indicating the farm where the potatoes were grown and certifying that no case of Wart Disease (Black Scab) of potatoes has occurred thereon, and (*b*) by a certificate from the Board of Agriculture and Fisheries, in the case of potatoes grown in England, the Board of Agriculture for Scotland, in the case of those grown in Scotland, and the Department of Agriculture and Technical Instruction for Ireland, in the case of those grown in Ireland, to the effect that no case of the said disease has occurred within five miles of the said farm.

Importation of Bees into St. Lucia.—Ordinance No. 8 of 1912, which came into operation on December 7th, 1912, prohibits the importation into the Colony of St. Lucia of (*a*) any queen-bee which is not accompanied by a certificate, approved by the Agricultural Superintendent, that the disease known as "Foul brood" does not exist in the apiary from which the queen-bee was taken, or (*b*) any bee-hive, or part of a bee-hive, or any article whatsoever which has been used in connection with bees, or any bees other than queen-bees as aforesaid.

The package in which the queen-bee is imported must be destroyed by fire in such place as may be appointed by the Agricultural Authority, and any worker-bee which accompanied the queen-bee must be killed and also destroyed by fire.

Every bee-hive or part of a bee-hive or other article adapted for use in connection with bee-keeping must be landed at the Port of Castries for inspection by the Agricultural Authority prior to delivery to the importer. (*Board of Trade Journal,* February 27th, 1913.)

Importation of Plants into Nyasaland.—A Proclamation issued under

the "Plants Protection Ordinance, 1912,"* provides that every package containing plants imported into the Protectorate through the medium of the post must contain a statement containing the full names of the kind and variety, the country of origin, and the name and address of the person or firm supplying such plants The importation of potatoes must be accompanied by a certificate from the official agricultural authority of the country of origin to the effect that they have been grown in areas known to be free from diseases or pests characteristically attacking potatoes

Where plants are intended to be imported otherwise than through the post, a statement containing the above-mentioned particulars, together with the prescribed certificate, must be posted by the consignor to the Controller of Customs, so that it reaches that official one month in advance of the consignment. All plants will be detained at the port of entry pending receipt of such statement and certificate, and if not received within one month subsequent to the arrival of the plants the whole consignment is liable to be confiscated (*Board of Trade Journal*, March 27th, 1913)

Importation of Animals into Australia. A Proclamation of the Commonwealth Government of March 1st last allows the importation into Australia from the United Kingdom of cattle, sheep, swine and goats which have not been within fifteen miles of any place affected with foot-and-mouth disease during the twelve months next preceding shipment

This Proclamation, however, does not modify that of November 2nd, 1912, referred to in the Board's Journal for February last, page 958, which, with the view of preventing the introduction of *Hypoderma bovis* (Warble fly), prohibits the importation into Australia of cattle from the United Kingdom except those shipped during the months from October to May.

Importation of Animals into the United States.—The Board issued a notice on March 15th to the effect that they had been officially informed that the prohibition against the importation into the United States of cattle, sheep, and other ruminants and swine from Great Britain, which was imposed in consequence of the outbreaks of foot-and-mouth disease last year, has been removed, and that the United States Department of Agriculture are prepared to resume the issue of permits for the importation of such animals

Notes on Agriculture Abroad.

Agricultural Education in Canada.—A Bill which has been introduced into the Canadian House of Commons provides for the expenditure on agricultural education during the ten years 1914–1923 of 10 million dollars (nearly £2,100,000) An amount not exceeding £4,200 per annum will be paid to veterinary colleges in proportion to the number of students; £4,200 will be paid each year to the Government of each province; and the remainder of the amount annually set aside under the Bill will be paid to the Governments of the respective provinces in proportion to their population

* This was summarised in the *Journal* for March 1913, p 1051

Institution of a Central Chamber of Agriculture in Russia.—According to a report by H.M. Commercial Attaché at St. Petersburg (Mr. Henry Cooke), a Central Chamber of Agriculture was opened at St. Petersburg on December 27th last, for the defence of agricultural interests throughout the whole of Russia. One of the first duties of the new Chamber will be the promotion of measures tending to raise the quality of Russian products exported to foreign countries.

The zemstvos and agricultural societies will continue to serve purely local agricultural interests

Phytopathological Service in France.—An account of the establishment of a service for the inspection of plant diseases in France was given in this *Journal* for September, 1911, p 516 A decree published in the *Journal Officiel* of January 26th, 1913, provides for the inspection of nurseries to be carried out by a staff of temporary inspectors appointed each year for the purpose of ascertaining the condition in which the nurseries are kept, and whether the consignments from the nurseries contain any harmful insect or fungus pests, and of granting certificates of inspection The expenses of inspection will be repayable by the horticulturists, whether a certificate has been granted or not, partly by a fixed annual charge of £1 for every nursery under inspection, and any deficit remaining will be covered by a charge in proportion to the market value of the produce in respect of which an application for certification has been made Horticulturists desiring to have their premises inspected must make application to the Ministry of Agriculture before April 1st of each year; and they must undertake not to include in their consignments produce which does not come from inspected nurseries without informing the inspector of the names and addresses of the nurserymen from whom the produce has come The premises of these latter nurserymen must be placed on the inspection list of the phytopathological service. A certified copy of the consular invoice accompanying the consignment must be sent with the request for a certificate of phytopathological inspection

Institution of a Phytopathological Service in Belgium.—A nursery inspection service now exists in Belgium by virtue of the Royal Decree of November 8th, 1912, issued under a law of June 27th, 1912

The Decree provides for the appointment of an inspector and assistants to carry out the inspection of premises where horticultural plants or nursery stock are grown, with a view more particularly to the issue of export certificates Owners or occupiers of such premises are bound to allow their inspection, and exporters are compelled to submit consignments to examination when required.

Transit.—The importation of plants for transit will be governed as heretofore solely by the regulations made under the International Phylloxera Convention, but otherwise importation and exportation will be affected by the regulations made in and under this Decree also

Importation of Plants.—The importation of plants affected with injurious insects or plant diseases is prohibited, and, if plants so affected are introduced, orders may be given for their destruction at the expense of the importer and without compensation. The Decree further gives authority for the making of Orders for the reshipment of plants, the restriction of importation to certain Custom Houses to be named, and, in serious cases, for the prohibition of the importation of any particular

kind of plant from any country, or the requirement of the production of certificates declaring the premises from which consignments proceed to be free from disease, and the consignments to contain no diseased plants.

Inspection and Export Certificates.—Plants can only be exported from premises recognised by the inspection service as free from disease. A certificate that any premises are so recognised may be obtained free of charge by the owner or occupier of the premises, and such certificate will be valid for six months, but the certificate will be withheld if and so long as any insect or plant disease is found on the premises. The owner or occupier must take all steps necessary for the removal of the disease. Export certificates are issued on the evidence of such inspection certificates, and if any consignment is to be exported which includes plants other than those grown on the premises, the exporter must obtain and produce the inspection certificate of the other premises before the export certificate will be granted.

The issue of certificates is governed further by Ministerial Decree of November 9th, 1912. This Decree provides that, while inspection certificates shall be issued free of charge, a fee of 50 centimes (5*d.*) must be paid for each export certificate, such as is required to accompany every consignment of plants sent to the United States of America and certain other countries.

Standards for Butter and Cream exported from Australia.—The standards required to be complied with in the case of butter and cream exported from Australia have been amended by Statutory Rules of December 4th, 1912, and by a Proclamation of January 4th, 1913, under the Customs Act, 1901–10. Butter exported must now contain no fat other than butter fat; not more than 16 per cent. (instead of 15 per cent. as heretofore) of water, 3 per cent. of casein, 0.5 per cent. of boric acid, and 4 per cent. of salt; not less than 82 per cent. of butter fat; and only colouring matter deemed by the Minister of Customs to be harmless. Cream exported must contain not less than 35 per cent. of milk fat, and must not contain any foreign substance. "Sterilised cream" exported must contain not less than 25 per cent. of milk fat, and must not contain any foreign substance, and must have been sterilised by heat and subsequently protected from contamination. (*Board of Trade Journal*, Feb. 6th, 1913.)

Mortality from Foot-and-Mouth Disease in Bosnia-Herzegovina.—According to the report on the trade, &c., of Bosnia-Herzegovina in 1911 (*F.O. Repts., Annual Series*, No. 5009) foot-and-mouth disease made its appearance in August, 1910, and spread all over the country, reaching its highest point in July, 1911, when there were 131,000 head of cattle, 130,000 sheep, 51,000 goats, and 26,000 swine affected. It then passed off as rapidly as it had increased, the last cases occurring in April, 1912. Of 923,247 cases in 1911, 2,529 ended fatally.

The Weather in England during March.

District.	Temperature.		Rainfall			Bright Sunshine.	
	Daily Mean	Diff from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean	Diff. from Average
Week ending Mar 8th	°	°	Inches	Inches		Hours	Hours
England, N E	43·8	+4·3	0·32	−0·10	5	4·9	+1·4
England, E ..	45·3	+5·7	0·24	−0·10	3	4·1	+0·6
Midland Counties	44·8	+5·1	0·36	−0·06	4	4·1	+1·1
England, S E	45·6	+4·8	0·26	−0·19	5	3·7	+0·3
England, N W	44·0	+3·9	1·18	+0·62	7	3·9	+0·9
England, S W	45·5	+4·0	0·50	−0·17	5	3·6	+0·2
English Channel	48·4	+4·2	0·78	+0·20	5	3·6	−0·6
Week ending Mar 15th							
England, N E .	41·9	+1·2	0·50	+0·08	4	3·9	−0·1
England, E .	43·9	+3·0	0·33	0·00	4	3·5	−0·4
Midland Counties	42·9	+1·9	0·88	+0·51	4	2·8	−0·6
England, S E	44·4	+2·4	0·46	+0·06	4	3·4	−0·4
England, N W	42·6	+1·4	1·20	+0·69	6	3·7	+0·4
England, S W	43·8	+1·3	1·23	+0·66	5	2·2	−1·7
English Channel	47·1	+2·0	0·31	−0·16	2	3·3	−1·5
Week ending Mar 22nd							
England, N E	38·8	−2·5	1·05	+0·68	6	4·7	+0·3
England, E	42·4	+0·6	0·99	+0·62	7	4·6	+0·3
Midland Counties	40·0	−1·8	1·54	+1·17	7	3·6	−0·3
England, S E	43·4	+0·5	1·20	+0·80	7	4·5	+0·3
England, N W	39·3	−2·6	1·42	+0·89	7	3·6	−0·3
England, S W	41·9	−1·4	1·95	+1·37	7	3·2	−1·2
English Channel	46·0	+0·3	1·34	+0·87	7	3·9	−1·3
Week ending Mar 29th							
England, N E	41·2	−0·6	0·57	+0·19	5	2·3	−2·4
England, E	43·4	+0·6	0·40	+0·04	5	2·5	−2·3
Midland Counties	42·1	−0·6	0·65	+0·26	4	3·1	−1·2
England, S E	44·1	+0·1	0·64	+0·28	4	3·3	−1·5
England, N W	41·7	−0·9	0·34	−0·22	3	4·2	+0·2
England, S W	43·6	−0·6	0·72	+0·13	4	5·1	+0·3
English Channel	47·6	+1·0	0·42	−0·05	4	6·2	+0·6

Notes on Agricultural Conditions Abroad.

The *Bulletin of Agricultural Statistics* for March, 1913, issued by the International Institute of Agriculture, gives figures of the cereal production of the chief countries of the world in 1912–1913. The countries included are Germany, Austria, Belgium, Bulgaria, Denmark, Spain, France, Great Britain and Ireland, Hungary, Italy, Luxemburg, Norway, Netherlands, Roumania, Russia in Europe (63 governments), Switzerland, Canada, United States, India, Japan, Russia in Asia (10 governments), Algeria, Egypt, Tunis, Argentina, Australia, and New Zealand.

Wheat.—The total production in all the above-mentioned countries amounted to 457,130,000 qr., as compared with 424,762,000 qr. in 1911–12, the increase being equal to 7·6 per cent. The area under production, however, shows a decrease of 2·1 per cent.

Barley.—The production in the above countries, with the exception

of India, Argentina, and Australia, was equal to 174,548,000 qr., against 164,248,000 qr in the previous year, or an increase of 6 3 per cent. The area planted was smaller by 0 6 per cent.

Oats.—For the specified countries, excluding India, Egypt, and Australia, the production amounted to 475,863,000 qr., this showing a rise of 20 5 per cent. over 1911–12, when the production was 394,772,000 qr The acreage under production was not so large as in the previous year by 1 0 per cent

Maize.—The total production in the above named countries, with the exception of Germany, Belgium, Denmark, France, Great Britain and Ireland, Luxemburg, Norway, Netherlands, India and Australia, amounted to 466,385,000 qr, as compared with 401,869,000 qr, in the previous year, or an increase of 16 1 per cent The area planted also showed a rise equal to 1 7 per cent

Japan.—The final figures of the oat crop in 1912 place the production at 564,000 qr, against 453,000 qr in 1911, the rise amounting to 24 6 per cent

Condition of Winter Cereals.—The condition of the crops on March 1st was as follows (100 being taken to represent the prospect of an average crop) —*Wheat*.—Denmark 91, Spain 85, Scotland 100, Luxemburg 100, Lower Egypt 105, Upper Egypt 101, Tunis 130 *Rye*.—Denmark 98, Spain 85, Luxemburg 99 *Barley*.—Spain 85, Luxemburg 130, Lower Egypt 93, Upper Egypt 101, Tunis 130 *Oats*.—Spain 85, Tunis 120

Italy.—According to the official report for the second decade of March, the condition of the crops in upper Italy is, on the whole, satisfactory, although in some cases rain would be desirable Light rains in the centre have further improved the crops, which already look well In the south and in Sicily the period under review was rather propitious, and the outlook at present promises well Fine weather and mild temperature favoured development and permitted of rapid progress in sowing (*Dornbusch*, April 7)

France.—The *Official Gazette* states that on April 1st the condition of winter wheat was put at 73, compared with 70 5 in March, 69 1 in February, and 71 in January, and that of winter oats at 73 5, compared with 71 3 in March, 72 in February, and 73 in January. (*Dornbusch*, April 8)

Germany.—The first official weekly crop report of this year says that in consequence of the belated clearance of the fields and excess of moisture, winter sowing was unduly protracted; and in many districts, especially on heavy ground, was not completed In most instances this will be made good by increased sowing of spring wheat, but as in some instances barley and oats are being sown instead of wheat, a small reduction in the wheat area is expected Under these conditions it was of great advantage to agriculturists that the weather was favourable for an early commencement of spring sowing. Winter sowings have, on the whole, come through the winter better than was expected in view of their previous poor condition and the severe frosts, but they are very irregular Subsequent more favourable weather has effected some improvement. (*Dornbusch*, March 31st and April 7th.)

Prussia.—The condition of winter wheat at the beginning of April was officially given as 2·7, compared with 2·5 at the same date last year; of winter rye 2·7, compared with 2·3; of winter oats 2·7; of clover 2·6, compared with 3·6; and of lucerne 2·6, compared with 2·9. (1=very good; 2=good; 3=average; 4=bad; 5=very bad.) (*Statistische Korrespondenz*, April 5.)

Hungary.—A report of the Minister of Agriculture of March 10th states that in the country as a whole, in consequence of the excessively wet autumn, 20 per cent. of the winter wheat area and 10 per cent. of the rye remained unsown. The area not yet cultivated will be sown with summer crops, and the sowing, in many districts, is already in progress. On the whole winter crops are mostly weak. (*Statistische Nachrichten*, March.)

Russia.—H.M. Vice-Consul at Nicolaieff, in a report dated March 19th, stated that field work had just commenced under very favourable circumstances in his district (comprising the Governments of Kherson, Kharkov, Poltava, Kieff, Ekaterinoslav, and Taurida). The area under spring corn will probably be greater than usual, since the autumn rains hindered the sowing of winter wheat and rye. Such winter grain as had been sown had wintered well. As far as could then be judged the prospects for all crops were distinctly good.

United States.—The Department of Agriculture, reporting on crop conditions on April 1st, state that the average condition of winter wheat for the whole country is estimated to be 91·6 per cent., compared with 93·2 per cent. in December last, and 80·6 per cent. in April, 1912. The average condition of winter rye is placed at 89·3 per cent., compared with 93·5 per cent. in December last, and 87·9 in April, 1912. (*Broomhall*, April 8.)

India.—The second General Memorandum on the wheat crop of 1912-13, issued by the Commercial Intelligence Department of India on March 13th, states that in provinces containing on an average 99·7 per cent. of the total reported area under wheat the total area sown is now reported to be 29,946,000 acres, which is to be compared with 29,187,500 acres (revised figure) at this date last year, and with 27,688,000 acres representing the average of the five years ending 1910-11. There is thus an increase of 758,500 acres, or 2·6 per cent., as compared with last year, and one of 2,258,000 acres, or 8·2 per cent., as compared with the average.

Argentina.—The first forecast of the yield of the maize crop issued by the Statistical Department on February 21st places the yield of the crop at 23,310,000 qr., as compared with 35,070,000 qr. in 1911-12. (*Dornbusch*, March 22nd.)

Chile.—The monthly report for January of H.M. Envoy Extraordinary, dated February 10th, stated that it was reported from all quarters that the harvest then being gathered would be an abundant one of excellent quality, and above.

Live Stock in Belgium.—The number of horses on December 31st, 1911, was 261,967, as compared with 255,229 in 1909, the increase amounting to 2·6 per cent. Cattle numbered 1,812,191, against 1,865,833, a decrease of 2·9 per cent., and pigs 1,229,428, against 1,116,500, an increase of 10·1 per cent. (*Bulletin of Agricultural Statistics*, March, 1913.)

Agricultural Conditions in England and Wales during March.

THE Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales during March, refer to the wheat crop in much the same terms as a month ago, viz., that it is generally healthy and promising except on heavy soils or land which has been flooded, where prospects are poor; also that the early sown wheat looks better than that got in later. The total area under wheat in England and Wales is expected to be some 3 to 4 per cent. below that of last year, although in the south-east of the country there is no material difference.

The dry weather in the early part of the month generally enabled some progress to be made with the cultivation of the land for the spring crops, but a recurrence of wet and stormy weather again hindered operations. In consequence, spring sowings were generally very backward, although there are some exceptions In many districts hardly any of the spring crops had been got into the ground This work was, perhaps, more advanced in the eastern corn-growing counties than elsewhere, particularly on light soils; indeed, most of East Anglia is considered to be forward Where showing the young crops appear satisfactory.

Fair progress with potato planting was being made in a few districts of Lincolnshire; but in the rest of that county, as in England generally, very little had been possible, as the land was not yet in a fit state In favoured areas, scattered throughout the country, some early potatoes had been got in

As the season progresses the reports of the lambing season are becoming more favourable, and many satisfactory reports are received from the north and Midlands, where the fall of lambs is practically everywhere at least average, and often good. In the south the reports are less favourable, but the later flocks would seem to have done rather better than the early ones. The lambs are very generally strong and healthy. Some losses from liver-fluke or other causes are reported from various parts of the country, but these do not seem to be heavier than usual

Prevalence of Animal Diseases on the Continent

The following statement shows that, according to the information in the possession of the Board on April 1st, 1913, certain diseases of animals existed in the countries specified —

Austria (for the period March 19th—26th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 202 Hofe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period February 16th—28th).

Anthrax, Blackleg, Foot-and-Mouth Disease (37 outbreaks in 28 communes), Rabies.

Bulgaria (no further returns received).

Denmark (month of January).
Anthrax, Swine Erysipelas.

France (for the period March 9th—15th).
Anthrax, Blackleg, Foot-and-Mouth Disease (116 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period March 1st—15th).
Foot-and-Mouth Disease (67 infected places in 41 parishes), Glanders and Farcy, Swine Fever.

Holland (month of February).
Anthrax, Foot-and-Mouth Disease (13 outbreaks in 6 provinces), Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (for the period March 5th—12th).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 16 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period March 10th—16th)
Anthrax, Blackleg, Foot-and-Mouth Disease (2,143 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (no further returns received)

Norway (month of February)
Anthrax, Blackleg.

Rumania (for the period February 21th—28th)
Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever

Russia (month of November)
Anthrax, Foot-and-Mouth Disease (5,777 animals in 145 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever

Servia (no further returns received)

Spain (month of January)
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (282 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis

Sweden (month of February)
Anthrax, Blackleg.

Switzerland (for the period March 17th—23rd).
Anthrax, Blackleg, Foot-and-Mouth Disease (70 "étables" entailing 806 animals, of which 17 "étables" were declared infected during the period), Swine Fever

Agricultural Labour in England during March.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in March.

Rain interrupted outdoor employment in the latter part of March in most districts, but not generally to any great extent, and the employment of labourers outside the regular farm staff was more affected in many districts by the wet state of the land than by rain. The demand for extra men

was generally only moderate, and arose chiefly from such work as threshing, hedging, and ditching, draining, carting, and spreading manure, while in some districts potato planting also provided a moderate amount of work.

The demand for extra men, although not large, usually absorbed the available supply, and in a number of districts more men were wanted than could be obtained This was particularly the case in parts of the following rural districts —Doncaster and Pontefract (*Yorkshire*), Bucklow (*Cheshire*), Basford, Blyth-and-Cuckney, and Retford (*Nottinghamshire*), Melton Mowbray (*Leicestershire*), Tamworth (*Staffordshire*), Atcham (*Shropshire*), Daventry and Potterspury (*Northamptonshire*), Buckingham, Eaton Socon (*Bedfordshire*), Chesterton (*Cambridgeshire*), Brigg, Gainsborough, and Spilsby (*Lincolnshire*), Smallburgh (*Norfolk*), Samford (*Suffolk*), Dover, Eastry, and Isle of Thanet (*Kent*), Blandford and Dorchester (*Dorset*), Kingsbridge and Tavistock (*Devonshire*), and West Penwith (*Cornwall*). The supply of extra men was, on the other hand, reported as somewhat in excess of the demand in the Clitheroe (*Lancashire*), Malton and Norton (*Yorkshire*), Sharnbrook (*Bedfordshire*), Epsom and Guildford (*Surrey*), and Mere (*Wiltshire*) rural districts.

Some scarcity of men for permanent situations was reported by one or more correspondents in most counties in the Midland, Southern, and South-Western groups, the demand being most noticeable in the Counties of *Worcester* and *Devon*. Many cases of increased wages for these men were reported, a rise of 1s a week being fairly general in certain parts of *Northumberland, Durham, Norfolk*, and *Kent*, while 1s 6*d* more a week was paid in a number of instances in *Lincolnshire*.

THE CORN MARKETS IN MARCH.

C. KAINS-JACKSON

Wheat —The interruption caused every spring by the Easter holidays is the most considerable of the corn trade year, London taking the whole week as a holiday, and many markets not now being held on Easter Tuesday. This season the exceptionally early date was welcomed by operators, as it gave them an uninterrupted spring campaign from April 1st to May 31st. Now that purchases for future delivery are customarily made on term, that is to say on contract to deliver on or before the last day of the month for which a price is quoted, the advantage of an uninterrupted period to the seller may be material, as it gives him a larger margin of opportunity in which to arrange to fulfil his contract. March itself, besides being a broken month, was otherwise unfavourable to holders of wheat, for the weekly arrivals proved heavy without the supply on passage falling. Add to this that the weekly cables of shipments disclosed exceptionally heavy exports, and the situation will be seen to have made for depression. At the end of the month it was seen that such depression had been excessive, because the exceptional vigour of the Continental demand had taken the sting out of the heavy shipments, and because the supply afloat was found to owe its high total

very largely to long-distance vessels bringing sorts of wheat such as Australian and Argentine, with which we are under-stocked, so that on their arrival they are practically assured of a prompt absorption into actual retail use. The prices of English wheat were fairly stable all through the month. A good quality region, including Kent, Essex, and Suffolk, reported 32*s.* and 33*s.* averages, while prices ranging from 28*s.* to 30*s.* were accepted in the north, in Lincolnshire, and in the Fenlands. The cheapness of English wheat as compared with foreign remained a feature of trade, for the cheapest foreign wheat which reached millers' standard was No. 4 Canadian, and that was tightly held for 36*s.* per 480 lb. Above this level millers paid 37*s.* for American red winter and for good Russian, 38*s.* for new Argentine, 39*s.* for best Canadian, 40*s.* for sound Indian of the old crop, 41*s.* for old crop New Zealand, and 42*s.* for old crop Australian. At the Baltic on the 31st, by which date business had been resumed in earnest, there was free buying of new Argentine on passage at 35*s.* 6*d.*, of new Australian on passage at 37*s.* 6*d.*, and of new Indian for May shipment at 39*s.* The Indian weighs 12 lb. more to the quarter than the Australian and Argentine cargoes. Two interesting features about these contracts were the level value of the wheat from the different colonies of Australia and of the two sorts of Indian, white and red. In the latter case the preferential price which used to be paid for white seems almost to have disappeared.

As regards the Australian colonies, we noted New South Wales 38*s.* 1½*d.*, South Australia 38*s.* 3*d.*, Victoria 38*s.* 1½*d.*, and Western Australia 37*s.* 6*d.* as prices taken. When we see Kent and Yorkshire varying by 4*s.* per quarer in home averages, the level attained by production over an area of 1,900 million acres is surprising Between 38*s.* 3*d.*, the best price making where the buyer selected his colony, and 37*s.* 3*d.*, the bid where the shipper kept the option of which colony he would draw upon, there was only 1*s.* per qr. difference. Indian wheat showed a little wider range, but here the range was only 2*s.* per 492 lb. The shipments of March proved to be 1,322,000 qr. from North America, 3,499,000 qr. from South America, 197,000 qr. from India, 643,000 qr. from Russia, 379,000 qr. from Europe S.E., and 901,000 qr. from Australasia. The Indian shipments were smaller than those for March, 1912, and the falling off in shipments from Europe S.E. was, of course, expected. All the other items showed an increase, though in the cases of Australasia and Russia it was not material. The supply on passage at the end of the month was 3,750,000 qr., an increase of 750,000 qr. in the thirty-one days. Granary stocks showed no increase, so that millers and other buyers must have taken arrivals quickly off the market on arrival.

Flour.—North America during March did not quite maintain the February rate of shipping, and to this extent helped English exchanges. On the other hand, the low prices accepted for April and May shipment did a good deal to undermine the confidence of spot holders. Household flour gave way 6*d.* on the month, cash prices on the 31st being 32*s.* 6*d.* top, 30*s.* 6*d.* whites, 27*s.* 6*d.* No 1, and 26*s.* No. 2 households. Country flour had a wider range than usual, as the quality and condition of locally grown wheat also varies a good deal. From 23*s.* to 27*s.* would cover perhaps 90 per cent. of transactions. Best Minneapolis patents

made 29s., Manitoba 28s 6d., Kansas 28s. Outside the offerings which have the hall-mark of a particular firm, ordinary good Minneapolis was to be had at 26s 6d, and Manitoba at 26s. There were a few buyers of fine Hungarian at 38s., Galatz at 34s, and French at 32s. per sack. The quantity on passage as the month closed was quite moderate—228,000 sacks Liverpool offered some Brazilian at 21s. 6d., and Argentine at 23s. per sack. The former was a novelty, and was taken, we hear, for high-class feeding use

Barley.—The supplies of the home crop are getting into a small compass, and, the seeding demand being over by Easter, the wide February range in prices had been reduced before March was over. The predominant type of deliveries in later March was a bold, rough "poultry" sort weighing 436 to 448 lb and fetching 28s to 30s. per quarter Imported barley was a very poor trade all through the month. Had an ordinary business been doing, prices must have risen, for the arrivals were below the usual at all the chief ports. Prices making on the 31st were 27s for Indian, 26s for Persian, 25s. for American, all per 400 lb, and 44s for Austrian, 43s for Chilian Chevalier, 38s for Chilian and Californian brewing, and 32s. 6d. for Argentine, all per 448 lb The shipments of March were 598,000 qr from Russia, 85,000 qr from Europe S E, 136,000 qr from India and Persia, 410,000 qr. from North America, and 15,000 qr from Argentina Compared with March, 1912, shipments were materially reduced, as the American increase was much more than balanced by the Russian decrease and by war in the Near East all but stopping barley exports from South-Eastern Europe. On the 31st there were 430,000 qr on passage, viz, 305,000 qr Californian, 60,000 qr Indian and Persian, 50,000 qr North Atlantic ports, 5,000 qr. South Atlantic ports, 5,000 qr Russian, and 5,000 qr Anatolian No Roumanian, Bulgarian, Salonica, or Australian barley is on passage to this country, while Canadian, Chilian, and North African consignments are of "parcels" only

Oats In English, local averages have shown a remarkably wide range In later March there was 9s 10d difference between Bedford and Lynn, places lying more or less in the same part of England The very low prices accepted all through the month at such great markets as Peterborough, Lynn, &c, witnessed to the grave injury done in 1912 Oats stand weather pretty well, but the chill September prevented many fields from ever getting really ripe Imported oats in March were mainly of one sort, Argentine, pressed on sale at all the chief ports week after week Other descriptions were scarce. The natural result was that the La Plata product closed at 16s. per quarter Good Scotch made 25s to 27s per 336 lb, good English 23s. to 25s. per 336 lb, fair Russian 18s to 19s per 304 lb, and fine Chilian 28s per 360 lb The quantity on passage rose to a high total, 700,000 qr. The month's shipments were 1,718,000 qr from South America, 112,000 qr from the United States, and 261,000 qr from Russia.

Maize.—The new crops in Argentina and South Africa are reported to be disappointing, but the cables at this time are apt to lean both to vagueness and to pessimism. South Africa so far looks like having a deficiency, that it is all but impossible to get a quotation to ship at all, but Argentina has been briskly accepting contracts to ship large quantities in June at 24s. 3d., and still larger quantities in July at

24*s.* per qr. Maize is a crop which takes two months to dry after the cob is detached from the stalk. The shipments of the month were 1,731,000 qr. from North America, 704,000 qr. from South America, 106,000 qr. from Russia, and 31,000 qr. from Roumania. On the last day of the month there were 600,000 qr. on passage.

Oilseeds.—Canada in March entered the field as a speculative seller of linseed for early summer shipment. The opening up of a new business is always interesting, and if the Dominion can grow linseed profitably while placing it on Mark Lane at midsummer for 43*s.* per 424 lb., a very large trade indeed is likely to become permanently established. The good weight should be noticed; it exceeds that of Indian by 14 lb., and of Argentine by 8 lb India is a slow seller of new crop linseed this season, but 44*s.* for Calcutta, 46*s* for Bombay were quotations for April shipment. Argentina did a good trade at 41*s* to 42*s.* in cargoes for prompt shipment There were 241,000 qr on passage at the end of the month, in the course of which India had sent off 58,000 qr. of old crop linseed, and Argentina 1,128,000 qr. of new crop. Nothing worth mentioning was shipped by North America or Russia. The trade in cottonseed has been dull; prices as compared with those of linseed are high Holders, however, cannot well be expected to make concessions when only 38,000 tons are on passage, as compared with 52,000 tons a year ago

Various.—Beet sugar has rallied, as it usually does when prices get down to ten shillings per cwt Pulse and rice in March favoured buyers, as did rice bran, in which a large trade is now done. Middlings, bran and pollard declined fully 5*s* per ton on the month. Some useful red Dari arrived from the East African Protectorate, and sold promptly at 28*s* per quarter Burmese haricots at eight shillings per cental attracted buyers, as at the price they deserved to do.

THE LIVE AND DEAD MEAT TRADE IN MARCH.

A. T. MATTHEWS.

Fat Cattle.—The supplies of fat cattle in English markets continue short of the average of the last three years by about 3,000 weekly, and, as a natural consequence, prices are showing a steady advance. The season for stall-fed cattle is now drawing to a close, and it is difficult to see how the demand is to be met during the weeks that must intervene before any cattle will be available from the pastures In most years there is a period of scarcity when the supplies from the stalls are exhausted, and it is quite probable that we may have to deal with a more serious one than usual this year

The average prices for the several breeds of cattle in English markets during March advanced gradually as the month progressed, and were as follows:—Shorthorns, 9*s.* 2*d* and 8*s.* 5*d.* for first and second quality, compared with 9*s.* and 8*s.* 3*d.* in February; Herefords, 9*s.* 4*d.* and 8*s.* 9*d.*, against 9*s.* 1*d.* and 8*s.* 6*d.*; Devons, 9*s.* 4*d.* and 8*s.* 5*d.*, against 9*s.* 1*d* and 8*s.* 4*d*; Welsh Runts, 9*s.* 1*d.* and 8*s.* 7*d.*, against 9*s.* 2*d.*

and 8*s*. 4*d*.; and Polled Scots, 9*s*. 5*d*. and 8*s*. 10*d*., against 9*s*. 4*d*. and 8*s*. 9*d*. These prices, though remunerative to the feeders, are considerably below those of the end of May, 1912, and the high price of stores in the autumn has diminished profits. The keen demand for lean stock for grazing at the present moment points to a feeling of confidence in future prospects on the part of farmers. That, however, is no indication whatever of what the autumn trade is likely to be, it being well known that graziers base their calculations of the value of stores on the price of beef at the time of purchase.

Veal Calves.—There was a distinctly increased demand for good veal the week before Easter, and prices were high. At no less than eight English markets as much as 1*s*. per lb. was recorded, and the average for the week was 10¾*d*. and 9½*d*., that of the other three weeks remaining consistently at 10*d*. and 9*d*. Yet many inferior animals were sold at 6½*d*. per lb.

Fat Sheep.—Supplies have been on a restricted scale, and buyers have been compelled to pay more money by fully ½*d*. per lb. than during February. Averages were remarkably level from week to week, but local circumstances have occasionally led to rather strong fluctuations in individual markets. For instance, prime Downs declined at Nottingham in the last week by 1*d*. per lb., and at Ipswich by ½*d*. This class of sheep has been quoted at Newcastle-on-Tyne during the month at 11½*d*. per lb., and 11*d*. at Leicester. One feature of the month has been the relatively high prices realised for Longwools, which have run the Downs very hard in average value. The following are the general averages:—Downs, 10¼*d*., 9½*d*., and 7½*d*. for the three qualities; Longwools, 10¼*d*., 9*d*., and 7¼*d*.; prime Cheviots, 11½*d*., and prime Crossbreds, 10¼*d*. per lb. Clipped sheep have been shown in large numbers at many markets, but the prices realised do not appear quite so good in relation to value as for those sold in the wool. Quotations have ranged from 8*d*. to 9*d*. per lb., and it must take a good fleece to cover the difference in the market value of the mutton.

Fat Lambs.—The lamb supply for Easter was unusually short, owing, at least in part, to the early date of that festival. Average prices were not much above the normal, but in exceptional cases phenomenal quotations were given. At Gloucester and Penrith choice lambs made 2*s*. per lb., but the general averages of the week in question were 1*s*. 3*d*. and 1*s*. 1*d*. per lb.

Fat Pigs.—Bacon pigs continue at a premium, and a further advance was established during March. The average in English markets was 8*s*. 7*d*. per 14-lb stone for small and 8*s*. for heavier pigs, against 8*s*. 4*d*. and 7*s*. 10*d*. in February.

Carcass Beef.—British.—Home-killed beef in the London dead-meat market was quietly steady at an advance of 1*d*. per 8-lb. stone on Scotch and 2*d*. on English in average prices. These were 4*s*. 10*d*. and 4*s*. 7*d*. for Scotch short sides and 4*s*. 8*d*. and 4*s*. 5*d*. for long or whole sides. English realised 4*s*. 6*d*. and 4*s*. 4*d*., and Irish about 4*s*. 5*d*. and 4*s*. 3*d*. per stone. The supplies of Irish have now become very small.

Chilled Beef.—The trade in chilled Argentine beef was very steady, and prices remained firm until the last week, when large arrivals caused a sharp decline of 4*d*. per stone, or ½*d*. per lb., on hind quarters. The

average prices were very similar to those of February, being 3*s*. 5*d*. and 3*s*. 2*d*. for first and second quality hinds, and 2*s*. 6*d*. and 2*s*. 3*d*. for fores.

Frozen Beef.—The trade for "hard" beef has presented no particular feature worthy of note, and prices have remained steady all the month without quotable change. New Zealand hind quarters have made 2*s*. 4*d*. to 2*s*. 6*d*., and fore quarters 2*s*. 1*d*. to 2*s*. 2*d*. per stone.

Carcass Mutton.—Fresh Killed.—After the first week, when very small Scotch carcasses were scarcely quotable, Scotch mutton met an even trade at 6*s*. per stone, or 9*d*. per lb. for 30-lb. sheep and 5*s*. 4*d*. for those of 56 to 60 lb. Prime English, or rather the best teg mutton on offer, made 5*s*. to 5*s*. 2*d*. per 8 lb. If choice small English mutton were consigned to the London market, these figures would be considerably exceeded.

Frozen Mutton.—Frozen mutton has been rather cheaper. New Zealand averaged 3*s*. and 2*s*. 7*d*. for first and second quality; Argentine, 2*s*. 8*d*. and 2*s*. 5*d*., and Australian, 2*s*. 7*d*. and 2*s*. 5*d*., a decline of 3*d*. per stone on the prices of February.

Lamb.—Fresh Killed.—British lamb has not been in very keen request and prices have been moderate, though slightly improving after the first week. It was then quoted at 7*s*. 8*d*. and 7*s*. 4*d*. per 8 lb., but has since stood at 8*s*. and 7*s*. 4*d*.

Frozen Lamb.—New Zealand lamb averaged 4*s*. 4*d*. and 3*s*. 10*d*. per stone for first and second quality, or about ½*d* per lb. less than in February. The best Argentine has occasionally made 4*s*., and Australian 3*s*. 10*d*. per stone.

Veal.—As usual in the London market, the range of quality and price for veal has been wide. The best British made 6*s*. 4*d*. per stone before Easter, and Dutch 6*s*. 8*d*. The average quotation for British was 6*s*. and 5*s*. 4*d*. for first and second quality.

Pork.—Supplies have been rather short, and the demand being steady, prices were very even all the month, the average for British being 5*s*. 4*d*. and 4*s*. 10*d*., and about 2*d*. per stone less for Dutch.

THE PROVISION TRADE IN MARCH.

HEDLEY STEVENS

Bacon.—The month of March has not brought about any easier prices; in fact, by the end of the month quotations were on the whole a little higher than at the commencement, and this fact has still further curtailed the consumption These remarks especially apply to American bacon and hams, as the supplies from that country continue unusually small, with no prospect of any material increase until the autumn. Near-by shipments of American hams are now held for from 20*s*. to 22*s*. per cwt. over prices asked at the same time last year, and shippers look for still higher prices by the time we reach the principal ham consuming period. As regards Continental long sides, no increase in the arrivals is expected until July, and with pigs high in price in Australia no material help can be expected from that country. The same conditions apply to Canada, and the shipments to this country are unusually small. The quantities of hogs being marketed in the

United States of America are still much below last year. For the month prices at Chicago have ranged from $8.20 to $9.40, against $6.15 to $7.70 last year, and $6 60 to $7.20 two years ago. On spot imported long sides are now from 14*s* to 17*s*. per cwt. above last year's prices at the same time. Some East African bacon is expected on the London market next month, and should find ready purchasers English pigs continue very scarce, and it is stated that in some cases as high as 13*s*. per score is being paid in the West of England for bacon pigs

Cheese.—Dealers again complain of want of animation in the demand for cheese, and in consequence prices show little change. The demand has been chiefly for best goods, which are difficult to find in any quantity either in English or Canadian makes

The arrivals from New Zealand have been large for the month, but will be proportionately smaller for April The loss of 1,030 tons of New Zealand cheese, said to have been destroyed or rendered unfit for food by the fire aboard the s s *Turakina* off Rio, has not had much effect on the market Stocks of New Zealand cheese in London and Bristol at the end of the month were 50,000 crates, against 24,500 crates at the end of March, 1912 Stocks of Canadian cheese at the three principal distributing centres (London, Liverpool and Bristol) were 115,000 boxes against 79,000 boxes at the same time last year, and 125,000 boxes two years ago Offerings of last season's English cheese continue free, but dealers operate cautiously, preferring to buy from hand to mouth at the prices demanded

Butter.—There has been more business passing in best selections, and higher prices have been paid The s s *Turakina*, referred to above, had aboard 1,140 tons of New Zealand butter, all of which is reported to be more or less damaged by fire and smoke, so that available stocks were reduced to this extent, and gave the English markets a firmer tone Secondary butters are plentiful, especially in Australian makes, and in consequence prices were irregular. A large make of butter is expected in Siberia, but the early makes are mostly going into Germany Dealers feel that we have seen the highest prices for this season, and will continue to buy from hand to mouth Butter is still high in price in America, fancy selections being quoted at about 156*s* per cwt , and in Canada equivalent to 135*s* to 140*s* per cwt , delivered England In a recent issue of the *Montreal Trade Bulletin*, the editor writes .—"At present stocks of choice creamery are very scarce and command top prices, sales being reported of choice New Zealand creamery at 30½*c* to 31*c*. in small jobbing lots In order to market round quantities, lower prices would have to be taken But there are not many large lots of choice grades to be had Several lots of new-milk farmers' butter pasteurised, have sold at 30*c*. to 30½*c* , and other small lots have brought 29½*c*. to 30*c* Cows are calving, and coming in profit more freely, and it will not be long before new butter will be on the market in larger quantities, and then everyone will want the new product before its supply is sufficient for the demand. Stocks of good merchantable butter are, no doubt, pretty low down "

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in March and February, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	MARCH First Quality	MARCH Second Quality.	FEBRUARY First Quality.	FEBRUARY Second Quality.
FAT STOCK:—	per stone *	per stone *	per stone *	per stone *
Cattle:—	s. d	s d	s d	s d.
Polled Scots	9 5	8 10	9 4	8 9
Herefords	9 4	8 9	9 1	8 6
Shorthorns	9 2	8 5	9 0	8 3
Devons	9 4	8 5	9 1	8 4
Welsh Runts . .	9 1	8 7	9 2	8 4
	per lb *	per lb *	per lb *	per lb *
	d	d	d	d
Veal Calves	10½	9¼	9¾	8¾
Sheep —				
Downs	10¼	9½	10	9¾
Longwools	10¾	9	9¾	8¾
Cheviots	11½	10½	11¼	10¼
Blackfaced	11¼	10¼	11	10
Welsh	10¼	9½	10	9¼
Cross-breds	10¼	9½	10	9¼
	per stone *	per stone *	per stone *	per stone *
Pigs:—	s. d	s d	s d	s d.
Bacon Pigs	8 7	8 0	8 4	7 10
Porkers	9 0	8 5	8 9	8 3
LEAN STOCK —	per head	per head	per head	per head.
Milking Cows:—	£ s	£ s.	£ s	£ s.
Shorthorns—In Milk	23 5	19 4	24 4	20 4
,, —Calvers	22 17	18 18	23 2	19 7
Other Breeds—In Milk	21 16	18 3	21 2	17 18
,, —Calvers	—	12 10	—	15 15
Calves for Rearing	2 8	1 17	2 9	1 17
Store Cattle:—				
Shorthorns—Yearlings	11 2	9 9	11 0	9 10
,, —Two-year-olds	15 9	13 8	15 4	13 3
,, —Three-year-olds	18 15	16 14	18 10	16 6
Herefords —Two-year-olds	17 13	14 15	17 1	15 2
Devons— ,,	16 0	14 14	16 0	13 14
Welsh Runts ,,	16 12	14 13	16 10	14 10
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s d	s d	s d	s. d
Downs or Longwools	50 4	44 3	48 6	42 9
Store Pigs:—				
8 to 10 weeks old	24 0	19 4	22 6	17 11
12 to 16 weeks old	36 9	29 4	34 9	26 9

* Estimated carcass weight

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in March, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality	Birmingham.		Leeds.		Liverpool.		London.		Manchester.	
		per cwt		per cwt.		per cwt.		per cwt		per cwt.	
		s.	*d*	*s.*	*d*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
BEEF :—											
English ...	1st	60	6	61	0	59	6	63	6	60	0
	2nd	56	0	58	6	57	0	61	0	56	0
Cow and Bull . .	1st	53	6	56	0	49	0	49	0	52	6
	2nd	46	6	51	6	41	6	45	0	48	0
Irish : Port killed .	1st	—		59	0	59	0	61	0	—	
	2nd	—		56	0	55	6	59	0	—	
Argentine Frozen—											
Hind Quarters .	1st	35	6	34	0	35	0	35	0	35	0
Fore ,, .	1st	30	6	29	6	30	6	30	6	30	6
Argentine Chilled—											
Hind Quarters .	1st	48	6	47	0	46	0	48	0	46	6
Fore ,,	1st	34	0	34	0	32	6	34	6	32	6
Australian Frozen—											
Hind Quarters	1st	34	0	33	0	32	6	32	6	32	6
Fore ,, .	1st	31	0	29	6	29	6	29	6	30	6
VEAL :—											
British . .	1st	85	6	76	6	88	6	84	0	87	6
	2nd	77	0	69	0	77	0	74	6	81	6
Foreign .	1st	—		72	6	—		88	6	—	
MUTTON :—											
Scotch .. .	1st	—		—		87	6	81	6	88	0
	2nd	—		—		83	0	73	6	83	0
English	1st	75	6	77	0	80	6	72	6	82	0
	2nd	64	6	73	6	76	0	69	6	77	6
Irish : Port killed ..	1st	—		—		80	6	—		—	
	2nd	—		—		75	0	—		—	
Argentine Frozen	1st	39	6	39	0	38	6	37	6	38	6
Australian ,,	1st	36	0	37	6	35	0	36	6	35	0
New Zealand ,,	1st	—		—		—		42	6	—	
LAMB :—											
British	1st	112	0	116	6	116	6	111	0	116	6
	2nd	102	6	112	0	107	6	102	6	107	6
New Zealand	1st	63	0	60	6	63	0	60	6	63	0
Australian .. .	1st	53	6	53	0	51	6	52	0	51	6
Argentine ..	1st	53	6	53	6	53	6	55	6	53	6
PORK :—											
British	1st	74	6	74	6	74	6	74	6	77	0
	2nd	70	0	72	6	70	0	67	6	73	0
Foreign	1st	—		—		—		72	6	—	

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913.

Weeks ended (*in* 1913).	WHEAT.			BARLEY.			OATS.		
	1911.	1912.	1913.	1911.	1912.	1913.	1911.	1912.	1913.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 4	30 5	33 2	30 5	23 11	33 3	28 6	17 0	20 7	19 10
,, 11 ...	30 8	33 1	30 3	23 10	33 0	28 4	17 2	20 8	19 2
,, 18 .	30 11	33 4	30 5	24 4	33 3	28 6	17 4	20 11	19 4
,, 25 ..	30 11	33 7	30 11	24 5	33 1	28 10	17 3	21 1	19 4
Feb 1	30 9	33 8	31 1	24 5	32 10	28 11	17 5	21 3	20 2
,, 8	30 5	34 0	31 0	24 6	33 2	28 10	17 5	21 4	20 1
,, 15	30 3	34 4	30 9	24 7	32 10	29 1	17 6	21 7	20 2
,, 22 .	30 2	34 6	30 11	24 9	32 8	28 8	17 7	21 9	20 7
Mar. 1 .	30 0	34 1	31 0	25 0	32 0	28 6	17 5	21 6	20 4
,, 8 .	30 1	34 1	31 3	25 0	31 7	28 5	17 5	21 8	20 0
,, 15	30 1	34 0	31 1	24 11	31 2	27 11	17 6	21 8	20 2
,, 22	30 2	34 1	31 1	25 0	31 10	28 6	17 5	21 9	19 11
,, 29	30 3	34 4	31 3	24 11	30 3	27 6	17 5	21 8	19 7
Apl. 5	30 4	34 10	31 4	24 7	30 9	27 0	17 7	21 11	19 2
,, 12	30 3	35 4		25 2	30 2		18 3	22 1	
,, 19	30 4	36 7		25 5	29 11		17 10	22 4	
,, 26 ...	30 11	37 10		25 5	30 4		18 3	22 9	
May 3	31 4	38 1		25 7	30 2		18 6	23 1	
,, 10	31 8	37 11		25 1	31 1		19 0	23 7	
,, 17	32 6	37 8		25 4	31 2		19 2	23 7	
,, 24 .	32 8	37 2		25 0	31 1		19 5	23 7	
,, 31 .	32 5	36 10		24 10	30 0		19 5	23 9	
June 7	32 4	36 11		25 7	29 11		19 7	24 0	
,, 14	32 3	37 0		23 11	30 8		19 8	23 10	
,, 21	31 11	37 5		23 9	30 8		19 10	24 0	
,, 28	31 10	37 10		24 5	30 2		19 9	23 11	
July 5	32 1	38 2		25 10	31 7		19 9	23 11	
,, 12	32 3	38 3		25 10	30 2		19 11	24 1	
,, 19 .	32 5	38 10		24 3	30 9		19 5	24 8	
,, 26 .	32 5	38 9		23 8	30 9		19 7	23 4	
Aug. 2	32 0	38 4		24 4	28 6		18 2	22 2	
,, 9 ..	31 6	39 2		26 9	30 7		18 0	22 4	
,, 16	31 6	38 2		27 8	28 3		17 10	21 8	
,, 23 .	31 8	35 6		28 10	28 1		18 0	20 10	
,, 30	31 7	34 10		28 4	28 6		18 3	20 8	
Sept 6	31 10	35 1		28 4	29 9		18 1	21 8	
,, 13	32 0	33 5		29 0	29 0		18 5	20 5	
,, 20	32 4	32 7		29 11	29 6		18 9	19 10	
,, 27	32 6	31 7		30 5	29 9		19 1	19 5	
Oct 4	32 7	31 8		30 9	29 7		19 5	19 8	
,, 11	32 9	31 10		31 0	30 4		19 10	19 5	
,, 18 .	32 9	32 2		31 5	30 11		19 11	19 9	
,, 25	33 1	33 1		31 7	31 6		20 6	19 10	
Nov 1 ...	33 4	33 4		31 10	31 10		20 8	20 1	
,, 8	33 4	33 1		32 7	31 11		20 11	19 11	
,, 15 .	33 1	32 10		32 10	31 2		21 0	19 9	
,, 22	33 0	32 1		33 5	30 11		20 10	19 11	
,, 29	32 10	31 9		33 10	30 8		20 11	19 8	
Dec. 6 ..	32 9	31 0		34 0	29 11		20 9	19 6	
,, 13 .	32 11	30 8		33 5	29 2		20 9	19 3	
,, 20	32 9	30 7		33 5	28 11		20 8	19 1	
,, 27 ...	33 0	29 10		33 4	28 6		20 7	19 2	

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU

		WHEAT				BARLEY.				OATS.			
		1912		1913		1912		1913		1912		1913	
		s	*d*	*s.*	*d*	*s.*	*d*	*s*	*d*	*s*	*d*	*s*	*d*
France	February	45	9	47	3	29	4	30	2	23	2	23	11
	March	46	7	47	7	29	8	30	1	23	5	23	10
Paris	February	47	4	47	6	29	0	31	0	24	7	23	6
	March	48	6	48	11	29	0	30	6	24	6	22	10
Belgium	January	34	5	34	7	29	7	30	5	23	10	22	8
	February	35	2	34	5	30	3	30	5	24	6	23	2
Berlin	January	45	3	43	0	—		—		27	0	24	0
	February	45	6	42	10	—		—		27	9	23	5
Breslau	January	40	2	37	10	32 28	10* 0†	29 26	5* 9†	25	2	21	10
	February	40	4	37	8	32 28	10* 6†	29 26	2* 5†	25	11	21	7

* Brewing † Other

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*, the Belgian quotations are the official monthly averages published in the *Moniteur Belge*, the German quotations are taken from the *Deutscher Reichsanzeiger*

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of March, 1912 and 1913

	WHEAT.				BARLEY.				OATS.			
	1912.		1913		1912		1913		1912		1913.	
	s	*d*	*s.*	*d*	*s*	*d*	*s*	*d*	*s*	*d*	*s*	*d*
London	34	10	32	8	35	3	25	10	23	2	22	4
Norwich	33	11	31	11	31	3	27	3	21	9	20	3
Peterborough	33	5	29	1	30	7	26	2	21	8	16	4
Lincoln	33	4	28	3	30	6	27	4	21	7	19	2
Doncaster	33	3	28	5	30	5	27	6	21	3	19	9
Salisbury	33	10	30	11	33	4	28	10	21	7	20	5

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in March, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.	
	First Quality.	Second Quality	First Quality.	Second Quality	First Quality	Second Quality
	s. d. per 12 lb	s. d. per 12 lb	s. d. per 12 lb	s. d. per 12 lb	s. d. per 12 lb	s. d. per 12 lb
BUTTER :—						
British	16 0	15 0	—	—	16 0	14 3
	per cwt	per cwt.	per cwt.	per cwt	per cwt.	per cwt
Irish Creamery	—	—	—	—	–	
,, Factory	102 0	90 0	104 0	94 0	—	—
Danish	—	—	135 0	132 0	133 6	132 6
French	—	—	—	—	136 6	130 0
Russian	110 0	108 0	112 0	110 0	112 0	110 0
Australian	115 6	110 0	114 0	110 6	116 0	112 0
New Zealand	121 6	119 0	120 6	119 0	121 0	117 6
Argentine	114 0	112 0	114 0	111 0	113 6	110 0
CHEESE :—						
British—						
Cheddar	75 0	65 0	75 0	72 0	78 6	74 0
			120 lb	120 lb	120 lb	120 lb
Cheshire	—	—	84 0	77 6	85 6	80 0
			per cwt	per cwt	per cwt	per cwt.
Canadian	65 0	62 0	64 6	62 6	65 0	64 0
BACON :—						
Irish	79 0	75 0	76 6	73 0	79 0	76 0
Canadian	73 0	71 0	72 6	69 6	73 6	71 6
HAMS :—						
Cumberland	—	—	—	—	114 6	107 0
Irish	—	—	—	—	107 0	103 0
American (long cut)	73 6	71 0	75 6	72 6	76 0	73 0
EGGS :—	per 120	per 120	per 120	per 120	per 120.	per 120.
British	9 4	7 8	—	—	10 0	9 2
Irish	9 4	8 10	9 7	8 8	9 7	8 7
Danish	—	—	9 8	9 0	9 7	8 7
POTATOES :—	per ton.	per ton.	per ton	per ton	per ton	per ton.
Edward VII	102 6	85 0	78 6	—	100 0	88 6
Langworthy	115 0	95 0	95 0	90 0	121 0	111 0
Up-to-Date	95 6	86 0	76 6	73 6	99 0	87 6
HAY :—						
Clover	105 0	90 0	110 0	90 0	129 0	114 0
Meadow	92 6	74 6	—	—	111 6	96 6

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE	MARCH.		THREE MONTHS ENDED MARCH	
	1913	1912.	1913.	1912.
Anthrax :—				
Outbreaks	71	120	174	326
Animals attacked	75	123	191	357
Foot-and-Mouth Disease :—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy) :—				
Outbreaks ..	19	23	47	46
Animals attacked .	50	57	140	103
Parasitic Mange :—				
Outbreaks	332	416	1,009	1,526
Animals attacked	51	849	2,134	3,561
Sheep-Scab :—				
Outbreaks . .	16	30	105	144
Swine-Fever :—				
Outbreaks .. .	200	307	467	790
Swine Slaughtered as diseased or exposed to infection	2,683	3,497	5,819	9,808

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland)

DISEASE.	MARCH		THREE MONTHS ENDED MARCH.	
	1913	1912	1913	1912.
Anthrax :—				
Outbreaks ...	—	—	—	1
Animals attacked	—	—	—	1
Foot-and-Mouth Disease :—				
Outbreaks		—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy) —				
Outbreaks .	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange :—				
Outbreaks	10	7	74	27
Sheep-Scab :—				
Outbreaks . ..	49	50	210	208
Swine-Fever :—				
Outbreaks	4	31	38	52
Swine Slaughtered as diseased or exposed to infection ...	39	221	200	413

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COMPOSITION OF FIRST-DRAWN AND LAST-DRAWN MILK.

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THE difficulties which are frequently encountered in relation to "presumptive" standards for milk have repeatedly given rise to a question as to the effect on the composition of milk of keeping back the "strippings," or milk last drawn from the udder. In view of this fact, the authorities of Armstrong College, Newcastle-upon-Tyne, have had a number of tests made at Offerton Hall, the County Durham Dairy Research Station. The work has been supervised by Mr. James McLaren, jun., who has also ascertained by means of the Gerber milk tester the percentages of fat present in the milk at the different periods of each milking, and has calculated the percentages of solids-not-fat by the usual method.

The tests were commenced on November 12th, 1912, and were completed on the following day. The cows were milked three times daily, and they were all milked under supervision at the usual hour on the evening of November 11th, so that the tests might be commenced under quite normal conditions on the morning of November 12th.

On the latter date the milk of two cows was tested in the morning, the milk of seven cows at noon, and the milk of four cows in the evening, with the results shown in Tables I., II., and III.

After these preliminary tests on November 12th, the milk of each of seven cows was tested at each of three milkings on November 13th. Six of the cows tested at noon on the

TABLE I.—YIELD OF MILK. NOVEMBER 12TH, 1912.

No of Cow	Weeks calved.	No of Calf.	Hours of milking and yield			Total yield.
			5 a.m.	12 30 p m	6 p m.	
			Pints	Pints	Pints.	Pints
11	6	3rd	—	8	—	—
13	6	3rd	—	8½	—	—
14	7	5th	11	6½	5½	23
16	4	4th	—	7½	5	—
18	1	4th	—	10½	—	—
35	28	4th	7	5½	3	15½
38	20	5th	—	4	3	—
Average Yield per Cow			9	$7\frac{1}{7}$	4⅛	19¼

TABLE II.—FAT IN MILK. NOVEMBER 12TH, 1912.

No of Cow	5 A.M			12.30 P M			6 P M		
	First-drawn (1 pint)	Strippings	Whole Milking	First-drawn (1 pint)	Strippings	Whole Milking	First-drawn (1 pint)	Strippings	Whole Milking
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
11	—	—	—	3·6	4·8	4·2	—	—	—
13	—	—	—	1·8	7·0	4·5	—	—	—
14	1·3	7·7	3·1	2·2	5·9	3·8	3·4	5·9	3·7
16	—	—	—	2·0	7·7	3·6	2·1	6·6	4·0
18	—	—	—	3·8	6·8	5·4	—	—	—
35	1·8	3·9	2·7	3·3	5·0	4·1	4·5	4·3	3·8
38	—	—	—	2·0	4·6	3·1	2·4	5·8	3·8
Average per Cow	1·55	5·80	2·90	2·68	5·97	4·10	3·10	5·65	3·82

previous day were again tested, but a seventh cow, No. 36, was substituted for cow No. 38.

The cows were all good milking animals of the ordinary non-pedigree shorthorn type, and none of them were old cows.

Yield of Milk.—Table IV. gives the yield of milk at each milking, as well as the total yields for the day. Considerably the largest yield was given in the morning after the longest interval between the milkings. The average milk yield of each cow for the day was 23½ pints, or practically three

TABLE III.—SOLIDS-NOT-FAT IN MILK. NOVEMBER 12TH, 1912.

No. of Cow.	5 A.M.			12.30 P.M.			6 P.M.		
	First-drawn (1 pint).	Strippings.	Whole Milking.	First-drawn (1 pint).	Strippings	Whole Milking.	First-drawn (1 pint)	Strippings	Whole Milking
	Per cent.	Per cent	Per cent	Per cent.	Per cent	Per cent.	Per cent	Per cent	Per cent
11	—	—	—	8 8	8·8	8 9	—	—	—
13	—	—	—	8 7	*	9 1	—	—	—
14	8 8	8 5	8·7	9 1	8·8	8 6	8 7	7·9	8 6
16	—	—	—	9 2	8·2	8 9	8 6	8·7	8 9
18	—	—	—	8 7	8·8	9 2	—	—	—
35	8 9	8·9	8·9	8 5	8·8	8 8	8.0	8·0	8 0
38	—	—	—	8 5	8·8	8 6	8 0	7 9	8 4
Average per Cow .	88 5	8 70	8·80	8 78	8·70	8·87	8·32	8·12	8·47

* The amount of milk was not sufficient to ascertain the solids not-fat

TABLE IV.—YIELD OF MILK. NOVEMBER 13TH, 1912.

No of Cow	Weeks calved	No of Calf	Hours of milking			Total yield.
			5 a m	12 30 p m	6 p m	
			Pints	Pints	Pints	Pints
11	6	3rd	10	7½	6	23½
13	6	3rd	9	9	5	23
14	7	5th	13	8	5	26
16	4	4th	10	7½	4½	22
18	1	4th	13	10	7	30
35	28	4th	9	5	3	17
36	55	5th	7	5	11	23
Average Yield per Cow .	—	—	$10\frac{1}{7}$	7[illegible]	6	23½

gallons. The cows were on the average about fifteen weeks past their calving, and were therefore in their full milking periods.

Fat in Milk.—Table V. gives the percentages of fat present in the milk at the different periods of milking. In each case the first pint drawn was kept separate and tested for fat. The last-drawn (the strippings) was also tested, as well as each whole milking of each cow.

Fat in First-Drawn Milk.—The first pint drawn from each

TABLE V.—FAT IN MILK. NOVEMBER 13TH, 1912.

No. of Cow.	5 A.M. First drawn (1 pint)	5 A.M. Strippings.	5 A.M. Whole Milking	12·30 P.M. First-drawn (1 pint)	12·30 P.M. Strippings	12·30 P.M. Whole Milking.	6 P.M. First-drawn (1 pint).	6 P.M. Strippings.	6 P.M. Whole Milking.
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent.
11	1·3	3·6	2·3	3·1	5·3	4·2	3·4	3·9	3·6
13	1·4	3·8	2·7	1·9	6·5	4·8	3·5	4·9	4·4
14	1·2	8·0	2·9	2·1	7·8	3·8	3·0	7·1	4·5
16	·6	6·8	2·6	·7	9·1	4·0	2·4	5·7	4·6
18	1·4	6·8	3·4	3·5	7·6	5·4	5·5	8·9	6·0
35	1·6	7·3	3·3	2·1	4·3	4·5	4·4	3·8	4·1
36	1·3	5·9	3·4	1·8	5·3	3·4	2·8	4·8	4·0
Average per Cow ..	1·26	6·03	2·94	2·16	6·56	4·30	3·57	5·59	4·46

TABLE VI.—SOLIDS-NOT-FAT IN MILK. NOVEMBER 13TH, 1912.

No. of Cow	5 A.M. First-drawn (1 pint)	5 A.M. Strippings	5 A.M. Whole Milking	12.30 P.M. First-drawn (1 pint).	12.30 P.M. Strippings	12.30 P.M. Whole Milking.	6 P.M. First-drawn (1 pint).	6 P.M. Strippings	6 P.M. Whole Milking
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent.	Per cent	Per cent
11	8·9	8·8	9·1	8·3	8·0	8·0	8·9	8·8	8·9
13	9·5	9·5	9·4	8·0	8·5	8·5	9·4	9·2	9·2
14	9·0	7·9	8·9	8·5	7·9	8·5	8·8	9·3	8·8
16	9·0	8·6	9·2	7·8	7·8	8·7	8·3	8·5	8·7
18	9·6	9·0	9·2	9·1	8·5	8·7	8·5	9·6	8·9
35	8·5	8·3	8·7	8·2	7·9	8·4	8·5	8·8	8·9
36	8·5	8·6	8·6	7·8	7·8	7·8	8·3	8·4	8·9
Average per Cow	9·00	8·70	9·01	8·24	8·05	8·37	8·67	8·94	8·90

cow contained on the average 1·26 per cent. fat at 5 a.m., 2·16 per cent. fat at 12.30 noon, and 3·57 per cent. fat at 6.30 p.m. In comparing these figures, it should be noted that the first pint of the morning's milking represented 10 per cent. of the total morning's milking, whereas the first pint of the noon's milking represented 14 per cent. of the whole noon's milking, and the first pint of the evening's milking about

17 per cent. of the whole evening's milking. This, no doubt, partly explains why the morning's first-drawn milk was the poorest in fat, but a more important reason for this being the poorest is likely to be the longer time that the morning's milk was in the udder after secretion.

Fat in Strippings.—On the large milk-selling dairy farms round Newcastle it is a common practice for each milker to strip the cow before he finishes milking, so that the milking and the stripping are done in one operation. At the same time a frequent practice is for the milking to be done in the ordinary way, and soon afterwards one of the more skilled milkers takes the last-drawn milk, or strippings, from each cow. The less skilled milkers leave more milk for the strippings, which, consequently, are likely to be less rich in fat, while the more skilled milkers leave less milk for the strippings, which are therefore likely to be richer. When stripping is practised the usual object is to make sure that all the milk has been taken from the cows. If this has not been done, the richest portion of the milk will have been left in the udder, and, further, the cows will in all likelihood gradually reduce their milk yield.

The strippings taken in this test at Offerton Hall vary in amount from a quarter to three-quarters of a pint, showing that the cows had been well milked at the ordinary milkings. Had more strippings been left in the udders, the percentages of fat in the strippings would probably have been considerably less.

The average percentages of fat in the strippings of each cow were 6·03 at 5 a.m., 6·56 at 12.30 p.m., and 5·59 at 6 p.m., but the milk of the individual cows varied greatly in this respect. The strippings of cow No. 11 had only 3·60 per cent. of fat at 5 a.m., while the strippings of cow No. 16 had up to 9·1 per cent. at 12.30 p.m., yet that cow had only 0·7 per cent. fat in the first pint of the same milking.

Fat in Milk of Whole Milking.—The average percentage of fat in the milk of the whole milking was 2·94 at 5 a.m., 4·30 at 12.30 p.m., and 4·46 at 6 p.m. Had the milkers failed to draw the strippings, assuming their average quantity to be half a pint (which was practically the case), the average percentage of fat of each milking would have been 2·46 at 5 a.m.,

3·66 at 12.30 p.m., and 3·86 at 6 p.m. These figures show the importance of milking cows right out at each milking.

Solids-not-Fat in Milk.—Table VI. gives the percentages of solids-not-fat as calculated. Evidently, when the whole of the figures are considered, the solids-not-fat have not been less in the first-drawn milk, nor have they increased in that last drawn; but the variations in these have been considerable in different cows and at different times of milking. Cow No. 18 had 9·6 per cent. solids-not-fat in the first drawn milk in the morning and the same amount in the strippings in the evening, whereas cow No. 16 had only 7·8 per cent. in the first drawn milk and the same in the strippings at 12.30 p.m. The averages for the solids-not-fat at the noon milking were all low, and in fact under 8·5 per cent., the "presumptive" standard of the Board of Agriculture and Fisheries, but this was evidently not due to the cows being milked at noon, as on the previous day the averages of the milk of seven cows, six of them being the same, were at noon well over the "presumptive" standard of solids-not-fat.

The cows were turned out for water daily, and were receiving the following daily ration:—4 lb. Bombay cotton cake, 2 lb. soy bean cake, 3 lb. maize meal, 4–6 lb. barley straw, 10–12 lb. meadow hay, and 60 lb. swedes.

They were fed according to the following time table:—6.30 a.m., 30 lb. swedes; 9 a.m., turned out for water; 10.30 a.m., half the cake and meal (dry); 1.30 p.m., turned out for water; 2.30 p.m., 30 lb. swedes; 3.30 p.m., hay; 4 p.m., half the cake and meal (dry); 5 p.m., straw.

Variations in the Fat in Milk during the Process of Milking.

Following on the tests outlined above, it was arranged that further tests should be made at Offerton on the variations in the fat in milk during the whole process of milking. The tests were made by Mr. J. McLaren, jun., and Mr. J. P. MacEwan, B.Sc., of Armstrong College. Four cows were milked on the evening of December 4th, 1912, under normal conditions, and on the following day these cows were milked at their usual times of milking, namely, 5 a.m., 12.30 p.m., and 6.30 p.m.

The amount of fat throughout each milking was tested in

each of the first four gills, then in each pint throughout the middle of the milking, and finally in each of the last four gills.

Table VII. on page 104 gives the results. The averages on this table cannot be calculated throughout, the reason being the variations in the milk yield of the cows. A study of this table shows that the morning milk was considerably the poorest, that the noon milk was considerably richer in fat, although the quantity of milk was not reduced at all, and that the evening milk was the richest in fat and considerably the smallest in amount.

A striking result is that on the average the first gill was richer than the second gill, and that throughout the milking there was a fairly steady increase in the fat, although there were some remarkable variations in the amount of fat in the successive pints with some of the cows. The last gill of milk drawn was also not as much richer than that drawn immediately before, as might have been expected.

The diagram on page 105 gives the variations in fat of the milk of each cow throughout each milking. It has been so drawn that wider spaces between the dots are left in the middle of the diagram in the case of cows with smaller milk yields. By this means the averages at the beginning and at the end of each milking are kept at their proper places in the diagram. The single dark line has been arrived at by averaging the whole of the milkings, and from this can be seen the gradual increase of the amount of fat in the milk from the beginning to the end of each milking. The rise in fat throughout the periods of milking was on the average fairly steady.

At the same time the diagram shows that the milk of the individual cows was very variable in its fat percentage throughout the period of milking.

An endeavour to arrive at some explanation of this result has been made at Offerton by milking three cows so that the milk from each teat was taken separately, and the results are shown in Table VIII. Considerable difficulty was experienced in doing so, as the cows would not give their milk freely with this method of milking, but the results indicated that the milk drawn from the different teats of the same cow varied considerably as regards the amount of fat present.

TABLE VII.—VARIATIONS IN THE COMPOSITION OF MILK DURING THE PROCESS OF MILKING.
OFFERTON HALL, DECEMBER 5TH, 1912.

	MORNING MILK (5 A.M.) Percentage of Fat					NOON MILK (1 P.M.) Percentage of Fat					EVENING MILK (6 P.M.) Percentage of Fat					
	Cow No. 14	Cow No. 16	Cow No. 18	Cow No. 48	Average	Cow No. 14	Cow No. 16	Cow No. 18	Cow No. 48	Average.	Cow No. 14	Cow No. 16.	Cow No. 18	Cow No. 48	Average	Mean of Averages
1st gill ..	1.0	1.0	1.2	1.5	1.17	2.6	1.5	2.5	2.5	2.27	3.4	2.2	5.8	3.3	3.67	2.37
2nd gill .	0.9	1.0	1.4	1.2	1.12	2.5	1.0	2.5	2.0	2.0	3.8	2.1	4.1	2.5	3.12	2.08
3rd and 4th gills ...	0.9	1.2	1.3	1.3	1.17	2.7	1.7	3.3	3.1	2.7	3.2	2.2	4.6	4.0	3.5	2.45
2nd pint .	1.0	1.1	1.6	2.1	1.45	2.8	2.1	4.2	3.8	3.22	3.5	2.2	5.8	5.5	4.25	2.97
3rd pint ...	1.3	1.5	1.7	3.1	1.9	3.4	2.7	4.8	3.6	3.62	4.0	3.4	6.1	5.4	4.72	3.41
4th pint ...	2.1	1.9	1.9	2.8	2.17	4.0	3.3	5.4	4.2	4.22	—	3.5	5.2	4.3		
5th pint ..	2.6	1.9	2.5	3.9	2.72	4.5	3.0	5.6	4.6	4.42	—	4.4	7.2	—		
6th pint ...	2.9	3.9	1.8	—		—	3.3	6.3	4.6		—	3.7	6.1	—		
7th pint ...	3.2	3.1	2.4	—		—	3.0	6.8	—		—	—	6.4	—		
8th pint ..	—	2.9	3.3	—	Average Yield = 12.25 pints.	—	3.1	8.0	—	Average Yield = 12.75 pints.	—	—	—	—	Average Yield = 8 pints.	Average Yield = 11 pints.
9th pint .	—	1.6	3.7	—		—	—	7.5	—		—	—	—	—		
10th pint ...	—	5.0	3.4	—		—	—	7.1	—		—	—	—	—		
11th pint ..	—	1.6	—	—		—	—	8.1	—		—	—	—	—		
6th last pint	—	—	—	—		—	—	7.0	—		—	—	—	—		
5th last pint	—	—	—	—		4.6	4.2	7.0	4.3	5.02	—	—	—	—		
4th last pint	4.0	2.4	3.7	3.7	3.45	4.9	4.4	8.4	4.3	5.5	—	—	—	—		
3rd last pint	3.0	3.3	3.9	3.1	3.32	4.6	4.4	7.4	5.6	5.5	4.0	3.9	8.5	4.3	5.17	4.66
2nd last pint	3.1	5.7	4.9	3.7	4.35	5.1	4.3	6.2	4.3	4.97	4.8	4.5	7.2	4.0	5.12	4.81
4th and 3rd last gills	4.4	7.9	5.4	3.9	5.4	5.2	6.4	6.9	4.6	5.77	4.6	4.9	7.2	4.0	5.17	5.44
2nd last gill	4.2	4.7	4.8	4.5	4.55	5.5	7.9	6.2	5.7	6.32	4.1	4.2	6.7	5.7	5.17	5.34
Last gill	4.1	4.5	6.0	4.4	4.75	4.5	7.3	7.3	5.1	6.05	6.1	4.4	7.3	6.0	5.95	5.58

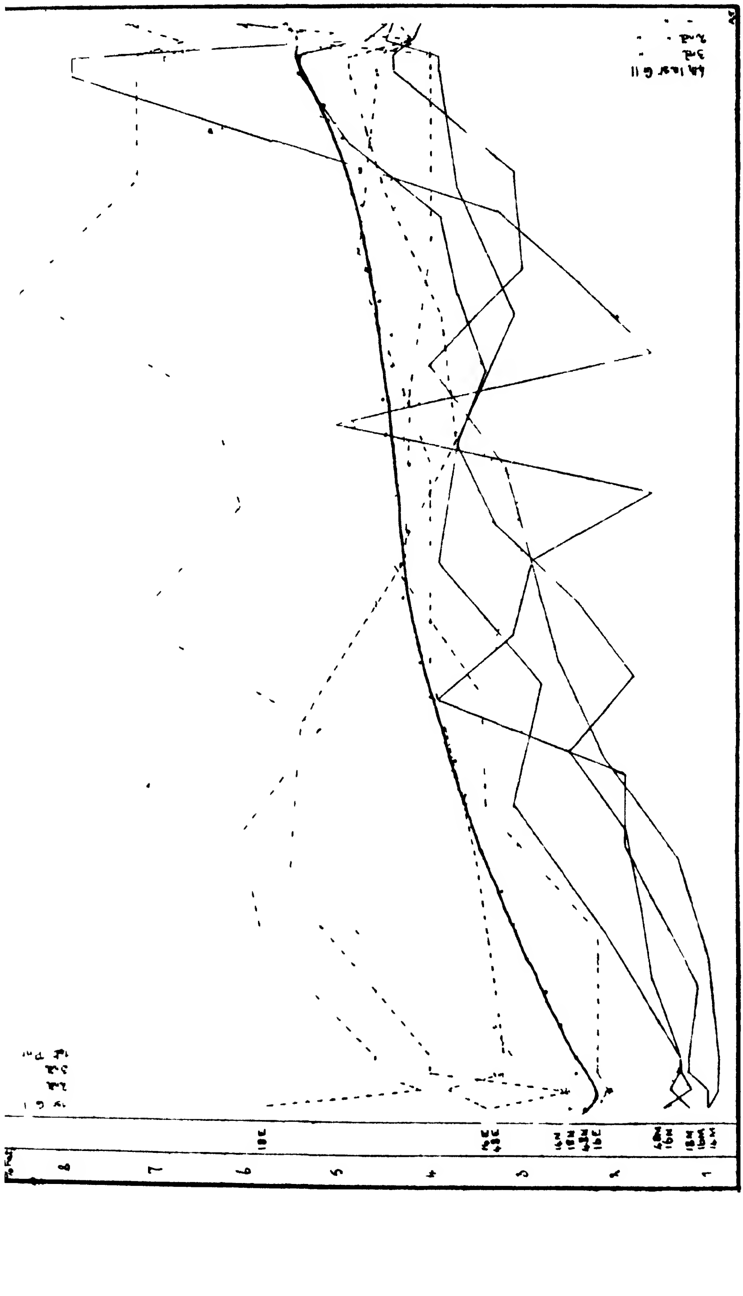

Diagram showing the variation in the fat content of the milk of each of four cows throughout each of the day's three milkings (M = morning milking, N = noon milking, E = evening milking).

TABLE VIII.—VARIATION IN THE AMOUNT OF MILK FROM DIFFERENT TEATS.

—		Fore left teat Fat per cent.	Fore right teat. Fat per cent.	Hind left teat. Fat per cent.	Hind right teat. Fat per cent.
Cow No 16	—First gill	1 2	1 0	1 5	1·2
	Whole milk	2 8	2 2	1 5	1 2
	Last gill	6 4	5 4	4 3	4 4
Cow No 10	—First gill	0 9	0 5	0 6	0 6
	Whole milk	1 4	1 8	0 9	0 7
	Last gill	2 3	5 5	2 7	2 2
Cow No 25	—First gill	1 6	1 0	1 8	1 2
	Whole milk	1 4	2 1	1 1	1 8
	Last gill	1 5	2 8	4 1	3 8

SOME NEW AND UNUSUAL INSECT ATTACKS ON FRUIT TREES AND BUSHES IN 1912

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SEVERAL interesting attacks of insects on fruit trees and bushes have to be recorded for the past year.

Amongst those of special interest is an Apple Leaf Sawfly (*Lygæonematus moestus*, Zaddach), which has not previously been recorded as British, and two aphides which have not before been described—one on strawberries, which I have named *Myzus fragariæ*, and the other on currants, and which has been described † under the name *Rhopalosiphum brittenii*.

It is interesting to note here the change of host plants by two insects, namely, the Beech Orchestes (*Orchestes fagi*), recorded as feeding on apples in Devonshire, and the Ash and Willow Scale (*Chionaspis salicis*) attacking currants at Woburn and Wye.

Three well-known insects are also recorded for the first time

* *The Entomologist*, Vol xlv., 1912, p. 223
† *The Journal of Economic Biology*, Vol. vii., Pt 3, p. 1071.

as attacking fruit in this country, namely, the Garden Chafer (*Phyllopertha horticola*), eating apples,* the V-Moth (*Halia wavaria*) on currants and gooseberries, and *Pseudococcus aceris*, Signoret, on apple trees.

A new Capsid Bug attack (a species of *Atractonomus*) on apples in Suffolk and Hereford is also worthy of notice. The number of *Capsidæ* attacking apples is gradually increasing. It is difficult to distinguish their damage to the fruit from damage by Thrips, and to the leaves from damage by Collembola. Catching the insects only will decide which is the culprit.

The Apple Leaf Sawfly.—The larvæ of this sawfly (*Lygæonematus moestus*, Zaddach †) have been sent to me from Week Green, near Petersfield (Hampshire), and from Mortimer (Berkshire), where they were feeding on apple foliage. I found a small colony also near Wye on a Worcester Pearmain in 1907, but did not rear them.

The larvæ were first sent to me from Week Green by Mr. T. E. Crompton on June 6th, 1911. He found them in two orchards 1¼ miles apart, and on June 10th he sent another supply, these being considerably smaller than those first received. The first pupated on June 13th and the last on July 22nd. Some of these pupated in the soil, others on the soil, and some amongst the foliage. Those in and on the soil covered the yellowish silk of their cocoons with fine particles of earth; those on the foliage had thick cocoons of pale dull yellowish to brownish silk. The adults hatched out from April 20th to May 5th, 1912.

The colony from Mortimer, twenty in number, was found on a "Mother" apple, and was sent to me by Mr. G. D. Lake on June 14th, 1912. All pupated amongst the foliage, making similar cocoons to those which pupated amongst the leaves

* The Board have records of this beetle attacking apples and other fruit in this country, at Newbury and at Stroud In the first case, which was determined beyond doubt, the correspondent wrote "the beetles have attacked fruit trees—even eating the few apples that other pests had left—raspberries and strawberries" In the second case the beetle was determined in 1908 as attacking apples, pears, raspberries, strawberries, and currants.

† *L. moestus*, Zaddach, is the same as *L. brevicornis* Th. 1862 (not of Cameron). The insects were identified by the Rev. H. Morice.

in the previous year. Others were found at Week Green in 1912.

The larvæ are very marked in appearance and feed freely on the leaves, mainly eating them from the edge inwards, but now and then devouring holes in the leaves.

The adult larva is apple green, with a small, somewhat irregular, black spot on each side of the first four segments, and a large round black spot on each side of the next seven segments; numerous small black specks occur on the first four segments and some on the sides of the others; the head is green, with black eyes; the legs are green. It is half an inch in length. A few showed a more yellow tinge.

The adult is shiny black, with paler incisions on the venter; the legs and also the base of the wings are pale.

The Beech Orchestes.—This well-known beech insect (*Orchestes fagi,* Barens) was reported and sent from Devon in June, as the cause of a serious loss to apples at Harpford, Ottery St. Mary. Captain Chancellor sent with the beetles a number of damaged apples upon which the Orchestes had been feeding. The method of attack is for the beetles to settle on the fruitlets when from the size of a filbert to that of a walnut. They collect in groups and eat small holes into the young apples, and as many as fifteen of the weevils were found in the same hole; some holes formed were half an inch across, while others were quite small. The attacked fruitlets also split from the seat of damage, sometimes on one side only, sometimes on both sides. Cox's Orange Pippins were mainly attacked (Fig. 1) and a large portion of the crop was ruined.

To verify the cause of this damage a number of Beech Orchestes were caught at Wye and placed on an apple tree under muslin; by the next day they had commenced to work in a similar way to those in Devon. The orchard in Devon was surrounded by beech and oak trees, and this well-known forest insect apparently suddenly changed its habits. As is well known, it lays its eggs in the beech leaves, the larvæ *tunnelling* into the leaves from the tips downwards.

The apples had been well sprayed with arsenate of lead, but this had no effect whatever on the beetles. A subsequent spraying with "Abol" appeared to check them.

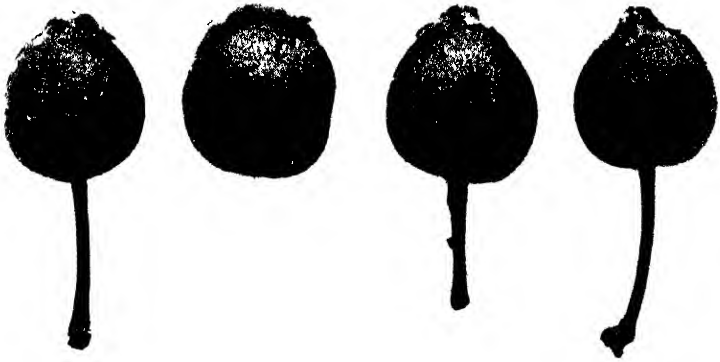

FIG. 1

Apples (Cox's Orange Pippins) attacked by the Beech Orchestes (*Orchestes fagi*, Barens)

FIG. 2

Apples damaged by the Garden Chafer (*Phyllopertha horticola*, Fabr.)

It was a surprise to find these beetles doing the damage; to ensure correct identification, Mr. Gahan kindly examined them for me.

It is interesting to note that in Illinois * an Orchestes, the *O. canus,* Horn, attacks apples, but in a different way. This weevil, named the Apple Flea Weevil, lays its eggs in the outer part of the leaf in one of the principal veins, and the larvæ tunnel into the leaf much as in the case of the Orchestes of the beech in Britain. In addition to this, the adult beetles eat holes in the foliage, just as our Beech Orchestes does in beech leaves.

It appears, however, that *Orchestes fagi* only attacked the apples themselves in South Devon, as no trace of leaf damage could be found.

The Garden Chafer Eating Apples.—Although well known as a destructive insect in its larval stage to grass and roots generally in Britain, I am not aware that the Garden Chafer (*Phyllopertha horticola,* Fabr.) has been noticed to attack apples in its adult stage in this country.† In May, Mr. Oswald Ellis, of The Fruit Farms, Bramley, Surrey, sent various apples badly damaged, as shown in the photograph reproduced here (Fig. 2), with an inquiry to know if the small chafers could possibly be the culprits. Later they were found in vast numbers and devoured the young apples ravenously. Worcester Pearmains were chiefly attacked. Many bush trees had fifty to one hundred beetles shaken from them.

Placed on apples much larger than those shown in the photograph they soon set to work, a single beetle spoiling no less than ten apples on one bright day.

A similar attack is well known in Germany. Dr. Reh ‡ describes and figures the damage caused by this chafer.

Jarring the beetles off is the only method of combating them. As they are active in bright weather, this should be done as far as possible in dull weather or towards evening.

The V-Moth.—The Looper caterpillars of this common moth (*Halia wavaria,* Linn.) were found by Mr. Neild, of

* Twenty Sixth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois, pp. 83–86. S. A. Forbes (1911).

† See footnote, p. 107.

‡ *Die Schadlinge des Obst- und Weinbaues.* Frankfurt, 1911, p. 41. Plate II, Fig. 29.

the Woburn Experimental Fruit Farm, to be very abundant on currants and gooseberries in that part of Bedfordshire in June of last year. I have never known it mentioned as a fruit pest in Britain, but Dr. Reh * refers to it in Germany. It is well known to entomologists as feeding on the currant and gooseberry, but it does not appear to have been noticed by practical men in sufficient numbers to have called for any comment. Morris, in his *British Moths*, records it as very common in most places. I have never found it in any commercial plantations in East Kent. In 1880 it was common in gardens round Ealing, and I have taken it in many gardens round London, while it used to appear now and again in gardens at Kingston-on-Thames, and I found it in small numbers in gardens in Cambridge from 1887–1892. In fact it generally appears to be a garden insect. It is strange it has not spread to plantations before.

The moths appear in July, and measure a little over an inch in wing expanse; the front wings vary in colour from grey to pale greyish purple with dark markings, one of which is roughly V-shaped; the hind wings are grey with a dark central spot.

The caterpillars are loopers of a green to pale green colour, with four waved yellowish white lines along the back, a pale yellow line on the sides, and some black spots. A brown variety also occurs. They are found in May and June, and when mature fall to the ground and pupate in the soil; the pupæ are dark brown. The caterpillars can easily be controlled by tobacco wash or arsenate of lead.

The Pear Leaf Curling Midge.—Reference to this midge (*Cecidomyia pyri*, Bouché) is made in my volume on Fruit Pests,† and an illustration of the damage done to the foliage is there given (Fig. 230). It is there recorded that the midge had never been complained of, but that it had been sent for identification and mention was made that it might so increase as to become a pest. This has proved to be the case, as it has so increased in one locality near Maidstone that it has already done considerable harm. The marked lateral rolling-up of the pear leaves at once enables one to identify the

* *Die Schadlinge des Obst und Weinbaues*, p. 19, Plate I., Fig 17

† *The Insect and Other Allied Pests of Fruit*, 1909, p. 350

attack. Usually both sides of the leaf are rolled, but sometimes only one side. The presence of the small creamy white footless larvæ in the rolled-up portions definitely settles the cause of injury. Attacked leaves lose their vitality and soon turn black when cut off the trees. To rear the flies the infested leaves must be left on the trees until the maggots are nearly full grown, as they cannot be transferred from one leaf to another.

The larvæ and much-damaged foliage were sent to me early in July, and at that time the larvæ had commenced to leave the foliage and enter the soil to pupate. From four to twenty larvæ were counted in various leaves examined. The flies commenced to hatch out on August 17th and went on appearing until August 27th. They were very active during the daytime. The colour mentioned in "Insect and other Allied Pests of Fruit" was brown, but when alive these small midges have a red abdomen. The general appearance is as follows:—The *female* has a blackish head with rather short, pale golden hairs and some small, almost flat, pale golden scales at the sides; the palpi are composed of four segments, the third and fourth longer and thinner than the other two, and pale brown; antennæ dark brown, composed of fourteen segments; the neck reddish-brown to testaceous; thorax black, with three lines of golden yellow hairs; scutellum deep reddish in some, brown in others, or even pale reddish; abdomen bright, deep red, with darker transverse lines above, formed by small brown flat scales, lateral hairs and a few dark brown ventral ones; ovipositor pale, slightly dusky at the apex, which is notched and telescopic; legs dark brown, the tarsi somewhat darker than the rest; wings smoky-grey, yellowish at the base, with black costal and first long veins, the latter almost straight and joining the costa at its apex; halteres pallid, yellowish at the base.

The *male* is similar in colour to the female, but the legs are grey, with dark brown tarsi; the thorax is black in the middle, reddish to reddish yellow round the sides and on the pleuræ above; genital claspers dark; antennæ composed of fifteen segments.

I found one female laying her eggs in a young tender leaf before it unfolded, inserting her telescopic ovipositor far into

the fold. This insect is double brooded. Winter is passed in the pupal stage in the earth.

The remedy suggested is to spread one of the naphthalene preparations beneath the trees when the larvæ are falling to earth; this at once destroyed them in pot experiments. The grower stated that on the whole all varieties of pear trees were attacked, but a few varieties showed a power of resistance.

Red Bugs Attacking Apples.—On May 30th Mr. Wm. Bear sent me some apples badly damaged by small scars over their surface, and with them some red larvæ (*Capsidæ*) and nymphæ. These he had received from Suffolk. Beauty of Bath was attacked and the whole crop practically ruined. Similarly damaged apples and foliage with the insects were also sent me from Hereford, the fruitlets being scarred and the leaves and tips much curled, some of the growing points being of a marked rusty colour.

The growers stated that the attack had been noticed for the past two or three years, appearing at the end of May and beginning of June, and becoming more prevalent each succeeding year. The points of the young terminals are first attacked, causing them to stop growth entirely, and later on, when the attack is over, growth recommences, three to four shoots appearing just below where growth has been arrested.

This damage was caused in both cases by a Capsid identified by Mr. W. L. Distant as *Atractonomus mali*, Meyer,* which has been previously recorded from fruit trees (Kaltenbach, *Die Pflanzen-Feinde*, p. 204, 1874).

These bugs have the first segment of the antennæ thickened, the long second segment gradually thickened to the apex, and both with rather dense, outstanding short hairs, the third and fourth segments filiform and pale in colour.

The nymphæ matured on July 2nd and so enabled the insects to be identified. As the nymphæ do so much damage and have not been described, they are here briefly referred to.

The nymph is bright red to brick-dust red; head and thorax somewhat darker, as also are the wing buds; clothed with fine, short golden pubescence. Antennæ with the first and second segments enlarged, densely clothed with short

* Meyer, *Rhyn.* Sp. 30, pl 2, fig. 5; *Fieb. Eur. Hem.*, p. 296, 1861; Saunders, *Hem. Heteropt. Brit. Isles*, p. 309.

black hairs, last two segments creamy white, the apical one slightly darkened; the first segment is thickest at the apex. Legs with dark femora and tarsi, tibiæ pale, except just at their base, the basal half of the hind pair dark. Proboscis pale, dark apically.

This Capsid very much resembles in appearance and its method of working the Red Bugs of the genus *Heterocordylus* of America. (Cornell University, U.S.A. Bull. 291. January, 1911. C. R. Crosby.) The damage done by this species is identical with that done by the *Psallus ambiguus*, Fallen, and *Orthotylus marginalis*, Reuter, and others in Worcestershire and Kent. (*Vide* Report on Economic Zoology for the year ending September 30th, 1911, p. 27, 1912, F. V. Theobald.)

These pests may be controlled when in the larval and nymphal stages by spraying with paraffin emulsion or nicotine soap-wash.

The Ash and Willow Scale Attacking Currants.—Two cases of this common ash and willow insect (*Chionaspis salicis*, Linnæus) attacking currants have to be recorded.

Mr. Spencer Pickering sent me specimens attacking currants at Woburn in May, 1912, a few bushes being thickly coated with this coccid. In May I found some on currants in my own garden at Wye, and in July an Ornamental Ribes in the College gardens was thickly coated with it. It had quite killed several shoots of the latter. This abundant scale insect has a wide list of host plants. Besides being found on ash and willow, it has been recorded on the Alder, Elm, Euonymus, *Viburnum latana*, *Acer campestris*, on Privet, Birch, Broom, Guelder Rose, Lilac, Poplar, and *Vaccinium*, in Europe. Fernald also gives *Cornus sanguinea*, *Tilia parvifolia*, *Sorbus aucuparia*, and on two species of *Sarothamnus*, in America.

I found it was easily destroyed on currants by spraying with paraffin jelly in late May when the red larvæ are found crawling out from under the grey scales. Lime-sulphur wash did not affect the scale in winter on a lilac, but caustic soda brought off most of the scales.

The Sycamore Coccus.—This woolly coccid (*Pseudococcus aceris*, Sign.) has also to be recorded as attacking fruit

trees. It was brought to my notice in June of last year in a plantation at Boughton Aluph. A few apple trees were coated with the females, and later the white ovisacs showed up prominently even at a distance. They swarmed on the butts of the trees, but many crawled up to the branches and some to the smaller twigs. Professor Newstead kindly identified this Coccid for me. I have failed to find it elsewhere in the neighbourhood. Where it had settled on young wood the shoot was killed. At the same time it was sent from Godalming, where it was killing some birch trees, another new host plant, so Mr. Newstead informs me.

Fernald (*Catalogue of the Coccidæ of the World*, p. 90) gives only Maple as a food plant, but Newstead (*Coccidæ*, Vol. II.) gives a long list of food plants, it apparently being a general feeder.

The Delicate Strawberry Aphis.—This very delicate green aphis (*Myzus fragariæ*, Theobald), which is often almost transparent, was sent to the Board of Agriculture and Fisheries from Hounslow in March, 1912. I found it again in great abundance in some strawberry houses at Rudgewick (Sussex) in May. It first seemed to occur only under the delicate young leaves, but later the larvæ, apteræ and nymphæ swarmed up the leaf-stalks, and in May I found them at Rudgewick all over the plants. Nymphæ first occurred on March 29th, many on April 4th, and winged females commenced to appear on April 10th. The colony sent to the Board kept on producing alate broods every now and again until mid-June, when the plants unfortunately were allowed to dry up.

The appearance of these insects on the pot plants when the light was shining on them was almost like fine drops of dew. They are easily kept down under glass by tobacco fumigation. The fine capitate hairs on these delicate insects are very marked. This aphis is related to *Myzus ribis*, Linnæus, which is found under the red blisters on currant leaves, but the sensoria on the antennæ of the alate female are markedly different, and they are of a very much paler green and more delicate appearance.

The Northern Currant Aphis.—This marked and handsome

aphis (*Rhopalosiphum brittenii*, Theobald) was sent to me by Mr. Britten, of Lalkeld Dykes, Penrith, where it was very abundant last year on currants and gooseberries. Both the winged female and the apterous female are yellow to yellowish-green, marked with black, and with large swollen black cornicles.

Apterous females were sent to me on May 4th, and alate females in mid-June. Mr. Britten found it most common on red currants, but fairly common on black currants and gooseberries. It curls up the young leaves in a similar way to *Aphis grossulariæ*, Kalt., and *Macrosiphum lactucæ*, Schrank. The swollen black cornicles will at once separate this Ribes aphis from all others.

The Dark Green Ribes Aphis.—Frequent inquiries have been made during the last five years concerning a dark green aphis which causes the tops of shoots of gooseberries and currants, especially red currants, to become much stunted and produce a dense tuft of terminal leaves.

This is *Aphis grossulariæ*, Kaltenbach, and is by far the worst Ribes species, not only on account of the type of damage, but also because it is not amenable to spraying. It can at once be distinguished by its dark green hue, paler cornicles, and by tubercles at the sides of the abdomen. It is found on the Ribes from the middle or end of May until July. As far as I have been able to trace, it appears on the currants as a winged female in May, and on the leaves in the middle of July. Its life cycle has not been traced, but there is some reason for believing it to be the same as the aphis (*Aphis viburni*, Schrank.) found on the guelder rose.

I have now received this aphis from Cumberland to Devonshire, and in all parts it seems to be equally destructive. Nothing but actually dipping the attacked tips in tins of nicotine wash or paraffin jelly has any effect, and as in gooseberries this aphis frequently ruins the growth of young bushes, this should be done. When devoid of leaves the deformed tips have often been believed to be damaged by American gooseberry mildew.

A Phytophid Attacking Apple Leaves.—In 1911 apple leaves were sent from several localities showing a somewhat obscure diseased appearance. A certain amount of Red

Spider occurred (*Bryobia* sp.), but the damage did not resemble the marked appearance of Bryobia attack. The leaves were blotched with brown and dark spots of irregular outline, and did not show the usual marbling of Red Spider attack. In August of last year leaves of several varies of apples similarly attacked were received from Sevenoaks, and beneath these were found short, thick, almost conical, yellow Phytopt mites belonging to the genus *Epetrimerus,* and closely allied to, if not identical with, either *Epetrimerus armatus,* Canestrini, found on *Cratægus oxyacantha,* or *Epetrimerus malinus,* Nalepa, found on apples.

The mites are found free on the under surfaces of the leaves, and are easily destroyed by spraying with paraffin jelly.

TECHNICAL INSTRUCTION IN PLOUGHING.

A. MURRAY.

No work on the farm is more important than ploughing, as it is the initial step in the preparation of every seedbed, and is the most commonly practised operation in the routine work of field cultivation. Notwithstanding this fact, the annual ploughing competitions, which must be taken as providing a fair sample of workmanship, reveal only too plainly the fact that many ploughmen are incapable of doing work of a really first-class character. Frequent examples may be seen of misshapen ridges with high backs, furrows irregular in width and depth, defective skimming, inequalities and depressions where there ought to be evenness and uniformity, all of which indicate a want of skill and judgment in the manipulation of an implement in everyday use.

A contributory cause of this is, no doubt, unskilful setting of the plough irons. It is a common thing to find the coulter several inches in front of the share, with the point three or four inches above it. Such an arrangement is incompatible with satisfactory work, or even with ease in ploughing.

The most difficult part in ploughing is "feering," or "striking out," as it is generally called—the preliminary step in commencing to plough. In executing this particular operation it is a common practice to bury or cover up one furrow only. By this method it is impossible to obtain a really good

"feering," because the furrow falls flat, having nothing to support it, and the second one which completes the first round falls on the top of it instead of standing more or less erect. Complete success in "feering" depends on the two first top furrows being placed back-to-back uniformly at the proper angle. When this is done accurately the effect is that one is unable to tell, at a cursory glance, which way the furrows have been turned, and this is the very essence of a good "feering," as it indicates accuracy of depth, precision in placing the furrow slices, and correct judgment as to width. This result cannot be attained unless two shallow furrows are covered; these, taken together, form a cushion on which the two top furrows of the second round can rest.

One great advantage in adopting the system described above is that much greater accuracy is obtained by having a furrow to guide the wheel of the plough during the first half of the second round. It is, of course, applicable chiefly to grass land. In the case of stubble or fallow land the method of "throwing-out" which ensures better disturbance of the soil is generally practised.

The next most difficult part is to finish up a ridge neatly with the ground exactly the same width at both ends. This requires considerable skill, involving accurate judgment and a keen eye. If the last top furrow is too wide a satisfactory finish is impossible.

Ploughs.—As far as ploughs are concerned it is only necessary to say that there is an endless variety in both size and shape, each having its own particular advantages. Most of them are, no doubt, capable of doing good work when placed in skilful hands. One thing, however, is certain—if exhibition work is the *desideratum*—implements made by firms who specialise in the work are indispensable, because they alone know how to construct them for a special class of work. Take one feature only, namely, that of the turnfurrow, or mould-board, which is made in many shapes and lengths. However advisable a short one may be in the case of stubble and root ground of the lighter class, it has a tendency to break up the furrow too much when used in ploughing lea. For neat, solid work a long breast of the proper sweep is required, which turns and places the furrow in the right position, and at the

same time keeps it entire. Makers of high-cutting ploughs not only construct the body of the implement in a special way to cut a furrow slice at a certain angle, but they also shape the fittings, and this means a great deal in the hands of a dexterous and experienced ploughman.

System of Instruction.—For several years the agricultural committee of the Hants County Council has fostered and encouraged a system of instruction in ploughing, the outlines of which may be of interest. In the first place, application for a grant is made to the County Council by representatives of the various agricultural societies throughout the county who contemplate organising a class for instruction. Each individual application is considered, and a sum of money is allocated for the purpose. The next step is the formation of a committee in connection with each local society to arrange the various centres, and organise the classes at the farms where the instructor will attend. The number of classes varies with the desire for instruction and the number of pupils available. Last year in the Romsey district there were five centres which mustered about sixty pupils, all of whom received a minimum of twelve hours' instruction each. The Director of Education for the county appoints the instructor and pays all expenses in connection with the classes. Difficulty is often experienced in obtaining the services of a suitable instructor, the particular class of man required being an expert ploughman with sufficient intelligence to impart instruction to others. Firms who specialise in plough-making keep expert men for what is called exhibition ploughing, but it is difficult to find men who combine the qualities of practical demonstrator and technical instructor.

When the instructor arrives at the farm where the class is to be held, he finds the pupils waiting for him with a team of horses and a plough. During the morning of the first day one plough is considered sufficient, as a good deal of preliminary instruction has to be got through. The pupils, varying in number from six to twelve, are mustered round the plough, and attention is centred on the implement. The instructor commences by explaining the general arrangement of the plough fittings, and possibly contrasts the various posi-

tions in which he finds them with those in which they ought to be, giving a reason in each case for the change or alteration of the part or parts. The general construction and setting of the plough is fully explained, and the proper names are given for the various fittings. Ploughs of different makes and their adaptability to special classes of soils are referred to, and also the utility of short and long turnfurrows and the influence they exert in shaping and placing the furrow.

After this oral instruction, the instructor takes the plough and shows the pupils how a proper "feering" should be executed. Instruction on these lines goes on throughout the morning. In the afternoon, if possible, several more ploughs are employed, and each pupil in turn has to perform a certain amount of ploughing, the instructor going from one to the other, rendering whatever assistance may be necessary, and taking the plough himself whenever the pupil is in difficulties and showing how the work should be done. For two days the instruction goes on in the same manner at each centre. Should the weather prove unpropitious for out-door work, a plough is brought to a shed and there taken to pieces bit by bit in the presence of the pupils, the various parts are named and explained, and the plough is reconstructed.

The more thorough the tuition the greater is the benefit, and it is felt that the instruction should be of such duration as to enable the pupils to benefit from it effectively. The pupils should be convinced of the value of the instruction, so that their interest may be fully maintained, and this can best be secured by making the teaching very thorough.

At the close of the period of instruction a ploughing competition is held, and prizes are given by the County Council to those whose work is considered of sufficient merit. All the pupils in the district may enter, the only restriction being that each competitor must have received the minimum number of hours' instruction. The improvement in the work of those who have received instruction is very marked indeed.

For reasons which are very obvious, it would probably be unwise to attempt too much at first, but the value of such practical instruction would be enhanced if a few lessons were given from a carefully prepared syllabus embodying some simple questions on dynamics, illustrative of draught, fric-

tion, and leverage as applied to farm implements. This would interest young men of the more intelligent type, and open their eyes to the usefulness of a better knowledge of farm machinery.

INFLUENCE OF "PICKLING" ON THE GERMINATION OF CEREALS.

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A large number of investigations on the effects of fungicides on cereals have been conducted in recent years, and the results show that, as regards the prevention of certain diseases, such as bunt and smut, suitable treatment of grain with such substances is undoubtedly effective. Care has, however, to be taken in selecting the strength of fungicides, since the use of too strong solutions will so seriously affect the germinating capacity of the seeds as to result in a decreased yield of grain. Conflicting views as to the effect on germination are expressed by various authorities, and one reason for such diversity of opinion may be the fact that, of the seeds used in the experiments, some would probably have been damaged in threshing, and these are likely to be killed by fungicidal solutions which leave ordinary grains unharmed. Again, it is possible that different varieties of the same cereal possess different degrees of susceptibility to the action of the same fungicide.

The method of "pickling" chosen may also affect the result. MM. Foex and Vidal * emphasise the danger of treating injured grains with fungicidal solutions, and recommend the method of sprinkling rather than that of immersion—a result which contradicts the general opinion held in Germany. They recommend treatment with a one per cent. solution of bluestone (copper sulphate) followed by lime, or a 0·3 per cent. solution of formaldehyde for ten minutes. Dr. von Sibrik † states that treatment with a 0·2 per cent. solution of formaldehyde for fifteen minutes is the best for wheat, while Mr. A. E. V. Richardson ‡ believes in a 0·25 per cent.

* *Progrès Agricole et Viticole*, September, 1911.
† *Wiener Landwirtschaftliche Zeitung*, December, 1904
‡ *Journal of the Department of Agriculture of Victoria*, May, 1912

formaldehyde or a 1·5 per cent. copper sulphate solution. The Board's Leaflet No. 92 recommends a 0·14 per cent. solution of formaldehyde, or a 0·5 per cent. solution of bluestone. A *résumé* of some important experiments on the subject will be found in the *Journal* of the Board for August, 1905.

A series of experiments has recently been conducted at the University College, Cork, with a view to determining the action of formaldehyde and copper sulphate solutions on the germination of cereals. The varieties chosen were wheat ("Red King"), barley ("Standwell"), and oats ("Abundance"). Attention was confined to the effect on germination, and only the perfectly healthy and plump grains were used. The room in which the experiments were carried out had an average temperature of 62° F., and the method of immersion was used throughout. A hundred grains were counted into a perforated porcelain cylinder, which was placed in the fungicide for the required time, during which the liquid was stirred. In one set of experiments the grains were washed previous to the germination tests, by placing the cylinder in clean water; in another they were planted directly from the fungicide. Germination was done on wide, tray-like shelves containing a depth of 6 ins. of clean sand, which was watered as required. No trouble was experienced with parasites of any kind; moulds, the bane of such experiments, did not develop on the seedlings.

Experiments with Formaldehyde.—The strengths of the solutions used were 0·06, 0·125, 0·25, 1 and 2 per cent. respectively. The cereals were separately immersed in these for ½, 1, 2, 3, 4, 5, and 6 minutes, thence by successive increments of three minutes to sixty minutes, then for 1, 2, 3, 4, 5, and 6 hours, and 1, 2, 3, 4, and 5 days. The chief results are shown in the table on p. 122.

Experiments with Copper Sulphate.—Ordinary bluestone, such as is used for agricultural purposes, was used in solutions of 0·25, 0·5, 1, 2, and 5 per cent. The times of immersion were ½, 1, 2, 3, 4 and 5 minutes; 1, 2, 3, 6, and 12 hours, and from one to five days. The principal results are given in the table on p. 123.

The above results were obtained with grains which had been washed before planting. The unwashed seeds gave

GERMINATION OF WHEAT, BARLEY AND OATS AFTER IMMERSION FOR VARIOUS LENGTHS OF TIME IN FORMALDEHYDE SOLUTIONS OF DIFFERENT STRENGTHS

—	0·06 % solution	0·125 % solution	0·25 % solution	0·5 % solution	1 % solution	2 % solution
WHEAT	5 mins., 85 per cent 6 hrs., 80 24 hrs., 78 ,, 48 hrs., none	5 mins., 82 per cent 57 hrs., none but grains swollen	$\frac{1}{4}$ hour 80 per cent $\frac{3}{4}$ hour 50 ,, 6 hours, 20 ,, (feeble)	1 min., 80 per cent 5 mins., 70 ,, 5 hrs., 10 ,, 30 hrs., none	$\frac{1}{3}$ min., 66 per cent 5 mins., 53 15 mins., 10 ,,	$\frac{1}{2}$ min., 60 per cent 5 mins., 50 ,, Growth very feeble
BARLEY	6 hrs., 90 per cent 24 hrs., 80 ,,	5 mins., 95 per cent 5 hrs., 90 ,,	$\frac{1}{2}$ hour, 92 per cent 3 hours, 85 ,, 1 hour, 50 ,, 5 hours, 20 ,, (feeble)	5 mins., 92 per cent 21 mins., 50 ,, 4 hrs., 10 ,,	5 mins., 85 per cent but none grew after this	5 mins., 60 per cent 30 mins., none Growth very feeble
OATS	5 mins., 95 per cent 3 days, 50 ,,	5 mins., 92 per cent Growth gradually retarded up to 30 mins., but percentage not much diminished up to 5 hours immersion	$\frac{1}{2}$ min., 100 per cent 5 mins., 90 ,, $\frac{3}{4}$ hour, 60 1 hour, 56 ,, 5 hours, 30 ,, (feeble)	5 mins., 90 per cent 3 hours, 10 ,, (feeble)	Same as Barley	5 mins., 70 per cent Growth still very slow, but better than barley and wheat

GERMINATION OF WHEAT, BARLEY AND OATS AFTER IMMERSION FOR VARIOUS LENGTHS OF TIME IN COPPER SULPHATE SOLUTIONS OF DIFFERENT STRENGTHS

—	0·25 % solution	0·5 % solution	1 % solution	2 % solution	5 % solution
WHEAT.	5 mins., 90 per cent 24 hrs., 65 ,, 2 days, 50 ,, 3 ,, 20 ,, (feeble)	5 mins., 90 per cent 12 hrs., 62 ,, 1 day, 50 ,, 2 days, 10 ,, 3 ,, none	5 mins., 85 per cent (With longer immersion, percentage was rapidly reduced.)	5 mins., 80 per cent 6 hrs., 62 ,,	5 mins., 68 per cent. 1 day, 10 ,, 2 days, none (Seedlings very small.)
BARLEY	Same as Wheat	5 mins., 90 per cent 6 hrs., 80 ,, 24 ,, 60 ,, 2 days, 20 ,, 3 days, 2 ,, (feeble)	5 mins., 87 per cent 6 hrs., 71 ,, 1 day, 50 ,, 2 days 20 ,, (feeble)	5 mins., 85 per cent. 24 hrs., 12 ,,	5 mins., 85 per cent. 1 day, 10 ,, 2 days, none.
OATS	5 mins., 94 per cent 1 day, 90 ,, 2 days, 60 ,, 3 ,, 25 ,, (feeble)	5 mins., 92 per cent 24 ,, 60 ,, (Seedlings small.)	5 mins., 85 per cent 1 day, 50 ,, 2 days, 15 ,,	Same as Barley	5 mins., 80 per cent. 1 day, 10 ,, 2 days, none (Seedlings small.)

slightly lower results, but they were so similar to the above that separate consideration is unnecessary. The fact that the sand was adequately watered would tend to diminish the fatal action of the fungicide. Throughout these experiments the barley was curiously resistant, and in general its germinating power was greater than that of wheat or oats, particularly after treatment in weak solutions. The oats stood strong solutions well; the wheat succumbed most easily. On comparing the two series of experiments it was seen that formaldehyde affected germination adversely according to its concentration, but the more marked depression caused by copper sulphate was very evident. Grains steeped in the latter took about twice as long to germinate as when "pickled" with formaldehyde.

Of the formaldehyde solutions, 0·125 per cent. seemed to be the most appropriate for practical purposes, as it did not have a very fatal or depressing effect, even after fifteen minutes' immersion, and it is a good fungicidal strength. But if used in such quantities that it barely covers the grain it should be frequently renewed. Immersion for five minutes in 5 per cent. copper sulphate did not injure barley or oats very much; but the best strengths were 0·5 per cent. for twelve hours for general uses, or 1 per cent. for six hours in the case of barley and oats.

Movable Hothouses.

ANY means by which glass-house work can be rendered more readily available for crops for market-garden purposes is likely to prove of great interest and value. One of the Board's Inspectors has recently visited Worthing to see the movable hot-houses introduced by Mr. Pullen-Burry. A movable hot-house is no new thing, but one type introduced some years ago has not been a success chiefly owing to the difficulty of moving it, and to the fact that the weight of the roof caused the sides to give. Both these points have been overcome in Mr. Pullen-Burry's invention, the weight being taken by what may be called the "chassis," which is low down and strongly built, while owing to the gearing arrangement, the whole affair can be easily moved with one hand. The wheels, which run on cement tracks, are plain, the cogs which drive them being at the side and meshing with a cog-wheel on

the shaft which runs through the house. An earlier pattern house, which Mr. Pullen-Burry still has in use, is a comparative failure owing to the torque or twisting in the shaft, which caused one end of the house to move before the other end started, but this has been overcome in the new houses and the two ends move together. The houses appear to be correctly built, and do not seem likely to give or collapse even after years of use, while the mechanism is simple and would not get out of order. The present house only allows of plants up to about eighteen inches in height being grown, but houses can be built on the chassis to any reasonable height to allow them to pass over trees and shrubs, which could be nailed up on trellis if necessary and bent down to allow the house to pass over them. The inventor finds that for some crops, *e.g.*, spinach, even three days' forcing makes a very great difference, and by means of the movable house not only can a succession of any particular crop be got, but crops can be so arranged on the plots that directly one crop is ready for marketing, the house is moved on to the next. As many of the crops, such as bulbs, asparagus, mint, &c., would remain in the ground for several years, a man would require comparatively little labour, and Mr. Pullen-Burry claims that one man can easily work an acre of land on this principle, while the theoretical profits are large. Although such profits would not always be obtained, there is no doubt that the profits should be good, as the crops would be early on the market when prices were high. Another advantage of the system is that such flowers as double narcissi and peonies, which cannot be forced if they are shifted, remain in their beds and are then readily forced.

Buildings for Small Holdings.

THE Departmental Committee which was appointed by the President of the Board of Agriculture and Fisheries to inquire and report as to the nature and character of the buildings which should be provided for use in connection with small agricultural holdings in England and Wales, have presented their Report (Cd. 6708, price 11*s.* 3*d.*, Wyman & Sons.)

The Report contains in an Appendix a list of plans and specifications of buildings for small holdings which are likely

to be of the greatest assistance to local authorities and landowners; and much of the information given in the Report itself is largely in the nature of a commentary on these plans.

A section of the Report is devoted to an account of the equipment of small holdings in Sweden, a sub-committee of the Departmental Committee having paid a visit to the Stockholm and Malmö districts in July, 1912, with the special object of obtaining information on the subject.

The plans and specifications constitute the main part of the Committee's recommendations. The more important general conclusions reached as a result of their inquiries are as follows:—

Generally.—The success of the occupier of a small holding requiring equipment, and in many cases the possibility of providing such holdings at an economic rent, will depend to a large extent, *firstly,* upon the land being purchased at a reasonable price, a result more likely to be attained if it is acquired in large areas than if it is bought in small detached lots; and *secondly,* upon the cost of the equipment being limited to such a sum as will suffice to provide the requirements essential to the profitable occupation of the holding.

As regards the cost of equipment generally, some saving may be effected if houses and farm buildings are erected either in pairs or groups within a limited area, thus enabling economy to be secured—

(*a*) by a reduction in the quantity of materials used;

(*b*) by a reduction in the cost of supervision, and the shifting of materials and appliances;

(*c*) by the standardising of doors, windows and fittings generally;

(*d*) by the provision of common roads and water supply;

The expense of subsequent maintenance and management will also be lessened if several houses are built together.

The House.—(*a*) *Design and Accommodation.*—The cost of the dwelling-house may be kept down by taking into consideration the immediate needs of the holding and carefully planning the house to meet those needs, allowing for the possibility of adding at a later period a parlour, and perhaps an extra bedroom, to a house in which only the necessary minimum of accommodation is provided.

No house built for a small holding should contain less accommodation than a living-room of 180 square feet, a scullery of 80 square feet, a larder or pantry of 24 square feet, and sufficient additional space for a fuel-store or other purposes to give a combined floor space on the first floor of at least 315 square feet for three bedrooms. A cubic space of not less than 500 cubic feet per adult person and 250 feet per child should be allowed in planning the bedrooms. It is recognised that these are, on the whole, small sizes, and only to be regarded as sufficient in exceptional cases where economy is so essential that space must be sacrificed to secure it.

(*b*) *Materials.*—In ordinary circumstances little economy is to be expected from the substitution of timber or unusual materials and methods of construction for those commonly employed in the erection of houses in rural areas; but interesting experiments with concrete are in progress, which indicate that its use may be attended with satisfactory results provided the work is carried out carefully and intelligently.

The Farm Buildings.—(*a*) *Accommodation.*—In the case of the farm buildings also, economy should be sought by limiting the equipment to the essential needs of the holding, and further by encouraging the occupier of the holding to do as much as possible for himself in the way of dividing off covered space, or putting up temporary buildings.

(*b*) *Materials.*—The use of timber instead of brick for farm buildings will entail a smaller initial outlay in the great majority of cases, particularly if the type of plan adopted is one designed specially for timber construction. To enable county councils to resort to timber construction without charging their tenants a higher rent than is entailed by the use of brick, it is necessary that the term of loan for the erection of timber buildings should be extended; the Committee think a period of at least 35 years is justified by the evidence of the durability of good timber construction.

No serious objection can be urged against the use of timber for the building of cowsheds, whether from the point of view of the health of the stock, or the purity of the milk supply.

Public Health Regulations.—Building regulations of a simple character are necessary in rural areas in order to

ensure wholesome conditions of development, and certain requirements might be made universal with advantage; but on the other hand, provided reasonable conditions of healthiness and sanitation are secured and the amenities of the locality preserved, it is desirable to remove any obstacle existing in local byelaws to the economical use of ordinary materials, or the substitution of unusual materials and methods, or the economical laying out and equipment of small holdings generally. This result would best be secured by waiving all but the minimum requirements for health and sanitation in cases where a rural or semi-rural character of development can be assured. A right of appeal to the central authority from local byelaws, and the vesting of the latter with further powers to secure the revision of unsuitable byelaws would also tend to the removal of some of the anomalies that exist at present.

The requirements of local Regulations under the Dairies, Cowsheds and Milkshops Order, and the method of interpreting those requirements might be reconsidered with advantage.

Exhibition of Plans and Models.—The establishment by the Board of Agriculture and Fisheries of an exhibition of plans and models of good types of houses and buildings for small holdings would be of great practical value, particularly if it were in a form that could be moved from place to place as occasion required, as for example to the Royal and County Agricultural Shows.

Encouragement and Improvement of Light Horse Breeding

The Annual Report of the Animals Division of the Board on the administration of the grant for the encouragement and improvement of the light horse breeding industry for the year 1911–1912 has been recently issued (Cd. 6697, price 3*d.*), and contains an account of the work accomplished by the Board as regards the encouragement and improvement of light horse breeding from November 1st, 1911, to October 31st, 1912.

The grant, which is approximately £40,000 a year, is made by the Development Commissioners for the purpose of encouraging and improving the breeding of light horses, in the

numbers of which there has been a serious decline in recent years. The chief means by which the Board are endeavouring to secure the object in view is by the provision of an increased number of high-class thoroughbred stallions for the service of half-bred mares at a low fee, and of about 1,000 selected mares free of charge. And in order to encourage farmers and others to keep brood mares of substance and quality for mating with thoroughbred stallions, the Board also arrange, through the agency of county committees, for the purchase of mares of this type for leasing out to suitable custodians at a small annual rent. Every possible action is at the same time being taken to encourage breeders to use only sound stallions for the service of their mares, and with a view of placing on the road as many stallions as possible that are free from hereditary disease and suitable for breeding purposes, the Board undertake the veterinary examination, free of charge, of all stallions, the service fee of which does not exceed £10, and the issue of certificates of soundness to all that pass inspection. Action is also being taken to improve the native breeds of mountain and moorland ponies as being the foundation stock from which the improved pony, the cob, and the polo pony derive their origin, and to which they owe many of their valuable characteristics of temperament, courage, intelligence, and hardiness. In addition, experiments are being carried out to test the possibility and commercial advisability of reviving the old "packhorse" and "roadster" breeds, which have, with the advent of good roads, railways, and mechanical traction, become almost defunct.

The Board appointed in 1911 a Council to advise them on all matters pertaining to the breeding of light horses, and Committees have also been appointed in every country to facilitate the scheme.

Results of the Service Seasons of 1911 *and* 1912.—In the service season of 1911, fifty King's premium stallions served or tried 3,245 mares, an average of 65 mares per stallion. Of the 3,245 service fees paid, 80 were in respect of trials, and of the 3,165 mares actually covered no information could be obtained of the results of the service of 245 of them. The foaling particulars received for the remaining 2,920 mares show that 1,567 foals were dropped, giving an average foaling

percentage of 53 66. This record of approximately one foal to every two mares served cannot be considered altogether satisfactory, and it is hoped that it will be possible to report an improvement in this direction in future years. The average amount paid by the Board in respect of a King's premium stallion for the service season of 1911 was £196, and the maximum amount £250, and when it is borne in mind that in addition a fee of £2 per service is payable by the owner of the mare it will be seen that the average earnings of these stallions can amount to £300, and the maximum to over £400.

In addition to the King's premiums, ten premiums of half value, known as Board's premiums, were awarded in 1911 to stallions recommended by county committees. These stallions served or tried 552 mares during the season, being an average of 55 mares per horse, and the percentage of foals got by them was 44. The average payment by the Board in respect of these premiums worked out at £93, and the maximum at £143. With the additional service fee of £1 chargeable to the owner of a mare the average value of a Board's premium was £135, and the maximum £219.

The service season of 1912 (King's premium stallions), so far as the number of mares served is concerned, proved very satisfactory—the number being 3,438, an average of 69 per stallion. The payments made by the Board in respect of the stallions (exclusive of foal fees) averaged £226 per horse, with a maximum of £334 10*s*. With the addition of the service fees of £2 payable by owners of mares, the average earnings of a stallion can amount to £336, and the maximum to £484 10*s*.

In 1912 Board's premiums were awarded to twenty-five stallions (20 Thoroughbreds, 3 Hunter sires, 1 Yorkshire Coach, and 1 Cleveland Bay)—an increase of fifteen on the number given in 1911—to travel various districts in England, Scotland, and Wales, and the results may be considered satisfactory. They served 1,655 mares, being an average of 66 per stallion. The owners also have reason to be satisfied with the results, as the average amount paid to them by the Board was £102, giving an average earning capacity of £156, inclusive of fees payable by owners of mares. The maximum earnings of one of these stallions was £204 10*s*.,

of which £129 10s. was paid by the Board. The above payments are exclusive of foal fees of 5s. per foal, which will be paid after the close of the foaling season of 1913.

Premiums to Welsh Cobs and Pony Stallions.—With a view to encouraging the breeding of cobs of the old Welsh stamp, five premiums of an average value of £50 were awarded in 1912. Six premiums of £20 were given to Fell Ponies with satisfactory results, and assistance was also given to mountain and moorland pony breeding by the award of premiums of £5 to six selected pony stallions in the New Forest and to four Welsh Mountain Pony stallions that were turned out to roam the hills at Church Stretton. Measures were also set on foot to encourage the breeding of Highland Ponies.

Free Nominations for Mares.—Free nominations to Premium stallions are given to small farmers and others to whom the fee charged for the use of such high-class sires is a serious item, and it is hoped that the result of this form of encouragement will be that owners of mares will realise the commercial advantages of mating their mares with sound sires of quality, and will give up the use of nondescript and often unsound stallions, the chief and perhaps the sole recommendation of which is a low service fee.

The value of a nomination to a mare for service by a King's premium stallion is £2, and £1 in the case of a Board's premium stallion. Nominations are issued by county committees in favour only of mares which have been examined by veterinary surgeons and passed as sound for breeding purposes.

In 1911 the county committees issued 676 nominations to King's premium stallions and 625 of these were used; 138 free nominations were issued to Board's premium stallions and 128 of them were taken up. For the year 1912, 738 free nominations were issued to King's premium stallions and 695 were used. The comparative figures for Board's premium stallions were 340 and 305.

Purchase of Brood Mares (1911–1912).—Before giving particulars of the procedure adopted for purchasing mares and leasing them out to custodians for breeding purposes, it may be of interest to review briefly the reason for this part of the

horse-breeding scheme. There is, and there will no doubt always be, a good demand and a good market, both at home and abroad, for high-class light horses. But with the increase of mechanical traction and the consequent decrease in demand for light-vanners and cab horses the market for misfits is necessarily on the decline. The hunting farmer, too, is fast disappearing, and his successor, who finds it more profitable to breed heavy than light horses, takes little interest in breeding horses fit to carry him to hounds. To these reasons may be attributed, at any rate in part, the diminution in the number of light horses bred in recent years. Representations were made to the Board that in many parts of the country there was a serious shortage of mares of the hunter type, and that farmers and others were giving up breeding, owing to the increasing difficulty of getting good brood mares of that class, and to the lack of suitable thoroughbred stallions available for mating with them at a reasonable fee. The Board recognised that it would be very inadvisable to encourage farmers to breed light horses of a type for which there is but little demand, and in view of the fact that there is always a good market for horses of the heavy-weight hunter type they decided to provide funds for the purchase of mares which, when mated with suitable thoroughbred stallions, are likely to produce stock of the class mentioned.

With this object in view, grants amounting approximately to £20,000 have been made to 36 county committees for the purchase of mares for leasing at a rental of £2 to suitable custodians for breeding purposes. One of the conditions of a grant is that the average price of the mare is not to exceed £50, and though representations have been received that this amount is insufficient, it is satisfactory to report that many excellent mares have been purchased below the figure mentioned. The question of whether any alteration should be made in the amount of the purchase price at present authorised will, however, be considered in the light of further experience. Over 400 mares have been purchased after veterinary examination, and nearly all of them have been inspected for conformation and soundness by inspectors of the Board. The majority of these mares are reported to be suitable for the purpose in view, but there are also unfortun-

ately a considerable number which are not of the type desired, and arrangements are being made for the disposal of them.

Registration of Stallions.—The results of the registration year 1911-12 (November 1st to October 31st) clearly show that owners of stallions are beginning to recognise the advantage of having their horses registered by the Board. In the previous year 313 stallions were registered and 44 rejected. In the year under review 715 were accepted for registration—220 of these had been registered in the previous year—and 90 refused, and of the latter 20 had been registered in 1911.

Of the number registered in 1911-12, 247 were Shires, 172 Thoroughbreds, 116 Ponies, 60 Hackneys, 57 Clydesdales, 36 Suffolk Punches, 19 Hunters, 4 Cleveland Bays, and 4 Yorkshire Coach Horses.

Of the number rejected 38 were Shires, 28 Thoroughbreds, 6 Ponies, 5 Hackneys, 7 Clydesdales, 5 Suffolk Punches, and 1 Hunter.

Although the figures mentioned show a decided improvement on those of the previous year there are undoubtedly a large number of sound stallions which are travelling the country without the certificate of the Board, but it is hoped that many of these will before long be placed on the register. Owners of mares can do much to further the object in view by refusing to put their mares to stallions that are not certified to be sound for breeding purposes.

Arrangements were made this year for the issue of a register of stallions which have been certified by the Board to be sound and suitable for breeding purposes, and it is hoped that it will prove of value, not only to the owners of stallions mentioned therein, but also to owners of mares who wish to know of sound stallions in their districts.

Sale of Impure Sulphate of Copper.

THE Board of Agriculture and Fisheries again desire to impress upon agriculturists and others the importance of securing pure copper sulphate when purchasing "blue vitriol" for agricultural purposes. The Board continue to receive evidence that impure copper sulphate is sold freely to persons who desire to purchase blue vitriol, the most common adulterant being sulphate of iron

(green vitriol), which is often present in large quantities, the mixture being artificially coloured to resemble copper sulphate. An Inspector of the Board recently purchased samples of "blue vitriol for wheat dressing," which, upon analysis, showed an average content of 12·5 per cent. of blue vitriol only, the remainder of the substance being green vitriol coloured with Prussian blue.

It should be borne in mind that the value of the material sold in these cases is practically in proportion to the amount of sulphate of copper present, and iron sulphate can only be regarded as an adulterant. It is advisable, therefore, in obtaining sulphate of copper to demand from the seller a guarantee of 98 per cent. purity, and to avoid purchasing the article sold as "agricultural" sulphate of copper.

The presence of iron in copper sulphate may be determined readily by dissolving a small amount in water and adding ammonia, the solution being constantly stirred till a deep blue liquid is formed. Any quantity of brown flocks floating in this blue liquid indicates the presence of so much iron that the copper sulphate should be subjected to a proper analysis before use.

Advisory Committee on Forestry.

The first Reports of the Committee appointed by Mr. Runciman on February 25th, 1912, to advise the Board of Agriculture and Fisheries on matters relating to the development of forestry have been published as a Parliamentary Paper [Cd. 6713]. The Committee have made separate reports on each of the three references* submitted to them.

As regards the first, they recommend that a Preliminary Enquiry or Flying Survey should be conducted, in the first instance, in the following districts:—South Wales; Westmorland, Cumberland, Northumberland; Kent, Surrey, and Sussex; Lincoln, Norfolk, Suffolk, and Essex; North Wales; Berks, Hants, Wilts, and Dorset; Derby, Lancashire, and the West Riding. Flying surveys should be started as soon as possible in the four first-mentioned districts, and where the Preliminary Survey discloses a sufficient area in any district suitable for afforestation, a Detailed Survey should follow to

* *Journal*, March, 1912, p. 1045

obtain the particulars necessary to justify the State in acquiring, if possible, an area for an Experimental Forest, which should contain not less than 5,000 acres.

As regards the second reference, the Committee recommend that the Forest of Dean with the adjoining Cram Woods should be selected for the purpose of a Demonstration Forest, which should serve as (*a*) an object lesson on the benefits arising out of systematic forest management and a centre for exhibiting accessory forest industries; (*b*) a practical training ground for forestry students; (*c*) a training ground for woodmen who wish to qualify as working foremen or head foresters; (*d*) one of the centres for the establishment of field experiments in sylviculture; and (*e*) one of the centres for the collection of statistics relating to forestry. The Committee make further recommendations as to the methods of conducting forestry research and sylvicultural experiment, based upon a memorandum (which is appended to the Reports) drawn up by the Board of Agriculture and Fisheries.

As regards the third reference, "to advise as to the provision required for the Instruction of Woodmen," the Committee recommend that the capacity of the Forest of Dean School and the Chopwell Woods School should be gradually extended, and that further courses should be provided at the Experimental Forests. Boys who intend to become woodmen and desire to qualify for the position of working foreman and eventually of head forester should, on leaving school at the age of fourteen to fifteen years, be apprenticed as woodmen on approved estates for a period of at least three years, and should thereafter, on production of certificates of conduct and health, proceed to the Forest of Dean, the Chopwell, or other similar school, where special facilities should be provided for their further training. The Committee recommend that County Education Committees be invited to offer a limited number of scholarships to assist the most promising of those apprentices who might otherwise be unable to proceed to a woodmen's school. One or two scholarships should be offered annually to enable the best of the students who have gone through a woodmen's school to proceed for one year to a centre for higher training. Supplementary to this method of training, short courses of lectures in practical forestry should be given at convenient centres.

Provision of Technical Advice in Forestry.

Central and Southern District.—Mr. S. Carr, whose appointment as Advisory Officer was notified in the January issue of the *Journal* (p. 850), has been compelled through ill-health to relinquish the post. Mr. B. B. Osmaston has been appointed in his place and will assume duty on the 1st July next. In the meantime applications for advice should continue to be addressed to Sir Wm. Schlich; from the 1st July applications should be addressed to Mr. Osmaston, School of Forestry, Oxford.

Eastern District.—Mr. Charles Hankins has been appointed Advisory Officer and assumed duty on the 1st April. Mr. Hankins will act in consultation with Mr. E. R. Burdon, M.A., School of Forestry, Cambridge, until the Reader in Forestry to succeed Mr. Augustine Henry is appointed. Until that appointment is made applications for advice should be addressed to the Secretary, Forestry Committee, 1 Free School Lane, Cambridge.

The North Wales Egg and Poultry Demonstration Train.

The Agricultural Organisation Society and the National Poultry Organisation Society recently organised an Egg and Poultry Demonstration Train, with the object of stimulating interest in the production and marketing of poultry and eggs in the northern counties of Wales. The train consisted of two large railway vans and a restaurant car. The vans were utilised as demonstration cars, and contained poultry appliances of different types, models of houses and coops, and various forms of boxes for the transport of eggs and of chickens. An interesting series of photographs showing the development of the embryo in the egg, and illustrations of different breeds of poultry were exhibited on the walls of the first van. The second van contained sample cases of Danish, French, Irish, Italian, and Russian eggs, samples of table poultry, and appliances for fattening, while the lower end of the van was converted into a dark room fitted with electric light for the purpose of demonstrating the methods adopted in testing

eggs. An ingenious method of illustrating the practical value of buying eggs by weight rather than by number afforded a useful object lesson. Six rectangular wire-work cages of identical dimensions were provided, and each one contained 60 eggs. Those in the first cage were thirteen-pound eggs, in the next fourteen-pound eggs, in the last eighteen-pound eggs. While the cage containing the thirteen-pound eggs was little more than half filled, the one containing the eighteen-pound eggs had but little room left in it.

The cars were so arranged that on arrival at one of the stations selected as a demonstration centre the public could pass through from one end to the other, and the various members of the staff were always available to explain the nature of the exhibits and to supply information to visitors. The demonstration on the testing of eggs was most interesting and of definite educational value. Meetings were held after the demonstration cars had been visited. The attendance was much greater than might have been expected, for visitors came from comparatively long distances, and were in no way deterred by bad weather. During the tour, which lasted from April 23rd to May 6th, 27 places were visited, and 18,966 people visited the demonstration cars, the average attendance therefore being about 700. The largest numbers were 1,827 at Pwllheli and 1,352 at Llangefni.

The L. & N.W. and Cambrian Railway Companies contributed largely to the success of the tour by their excellent organisation.

Evidence was not lacking that the work undertaken by the Societies responsible for the general organisation of the scheme was appreciated. The amount of local interest aroused has already been referred to, and this interest was shown in a tangible form by the substantial contributions which were made by residents in the different counties prior to the visit of the Demonstration Train. As a means of carrying out pioneer work, of providing a method of rapidly reaching a comparatively large section of the population, of arousing fresh interest, and of bringing poultry keepers into touch with the educational means which are available to assist them, the North Wales Egg and Poultry Demonstration Train has served an important purpose. In the districts in which this

possible that a smaller dressing of superphosphate might have proved profitable. The further addition of sulphate of ammonia and of muriate of potash to the superphosphate gave notable increases in the crop, but not sufficient to pay the increased cost of the artificials

The effect of replacing 1 cwt muriate of potash in the mixture by 4 cwt of agricultural salt was to reduce the yield, but there was very little difference in the financial return

Of the nitrogenous manures in the mixture, nitrate of soda gave much the best return (the complete mixture of artificials containing nitrate of soda giving a very satisfactory profit) Nitrate of lime gave the second best return, followed by sulphate of ammonia, whilst calcium cyanamide proved least satisfactory

Experiments with Nitrogenous Manures (*Arb der deut Landw. Gesell , Heft* 217)--These experiments are reported by Prof Schneidewind, of the agricultural experiment station at Halle They were carried out during seven years on a variety of soils with rye, wheat, oats, potatoes, turnips, and sugar-beet The following are the general conclusions drawn --

On the average nitrates gave the best results Nitrate of soda (Chili saltpetre) and nitrate of lime (Norwegian saltpetre) were found almost equal in value Taking the increased yields of grain, roots and tubers produced by nitrate of soda at 100, the increase produced by sulphate of ammonia (field experiments) was 88 5 In one year of the experiments, however, the sulphate of ammonia did better than nitrate of soda, and on the average of the whole seven years it gave as good results as nitrate of soda for oats and potatoes

The increase produced by calcium cyanamide in field experiments was 68 5 (nitrate of soda 100) Its value relative to nitrate of soda was greater than this in some cases, however, *e g* , as an autumn manure for winter cereals, the value compared with the spring dressing of nitrate of soda was 88, and its relative value for wheat on a good soil was 96

Compared with the preceding manures, liquid manure was a failure, both on sandy soils and on loams Experiments showed this result to be due to loss of nitrogen from the manure Liquid manure was only comparable in effect to nitrate of soda or sulphate of ammonia when it was immediately buried deep in the soil, this being not always possible in practice

Spring and Autumn Applications of Manures for Winter Cereals Autumn manuring with sulphate of ammonia did not give nearly such good results as spring manuring with nitrate of soda on sandy soils, since on light soils during the winter a large amount of nitrogen was lost from the sulphate of ammonia distributed in autumn Exceptionally, however, it is possible that good results would be obtained from the autumn application of sulphate of ammonia on sandy soils if followed by a dry winter, as indeed occurred in one year of the experiment On heavier soils the autumn application of sulphate of ammonia gave good results in one year even better than spring manuring with nitrate of soda the effects of the latter manuring not being felt until later, on account of the dry spring. As a spring manure for winter cereals sulphate of ammonia on better soils had on the whole very

bad results, while on dry sandy soils the spring application was much more effective than the autumn application.

The autumn application of calcium cyanamide on sandy soils gave on the average worse results than the spring application and much worse than the spring application of nitrate of soda. On the heavier types of soil, however, the autumn dressing of calcium cyanamide had good results—far better, in fact, than the spring dressing.

It is concluded from the experiments that large applications of manures in autumn on light soils are, in most years, simply money thrown away, while on better soils autumn manuring with sulphate of ammonia and calcium cyanamide, especially in the case of wheat, can be advantageous. It must be mentioned, however, that most of the winters during the experiments were very dry, and nitrate of soda applied in the autumn had almost the same effect as sulphate of ammonia.

Quantities of Manures. In considering the quantities of manures used in the experiments it must be mentioned that the plots had for several years received no farmyard manure. On plots of rye on moist sandy soils and sandy loams, a dressing containing 53 lb. nitrogen per acre proved profitable; the dressing was unprofitable on a dry sandy soil, and here as a rule 180 lb. of nitrate of soda per acre can be regarded as sufficient for rye.

For wheat the dressing of 53 lb. nitrogen per acre proved profitable on humid loams; for potatoes 53 lb. nitrogen per acre on moist and dry sandy soils was profitable, while on loams 18 lb. nitrogen, and on clay soils 36 lb. nitrogen, were sufficient. With turnips a dressing of 80 lb. nitrogen per acre was profitable, both on moist sandy soils and on loams.

Nitrogenous Manures on Mangolds, 1910 and 1911 (*County Agric. Expt. Sta., Cockle Park, Northumberland, Bull. No.* 18, 1912).—Yellow Globes were sown on small plots of $\frac{1}{12}$ acre. Each plot received the following per acre:—2 cwt. basic slag, 300 lb. sulphate of potash, 2 cwt. salt, and a nitrogenous manure. The results per acre were as follows:—

Plot	Nitrogenous Dressing	Cost	Yield. 1910	Yield. 1911
		s. d.	tons cwt.	tons cwt.
1	516 lb. Nitrate of Soda	46 2	37 4½	24 13¾
2	616 lb. ,, Lime	49 0	37 4	25 14¾
3	400 lb. Nitrolim	39 5	29 4	19 12
4	400 lb. Sulphate of Ammonia	47 5	31 2	—

The dressings all contained 80 lb. nitrogen per acre.

Nitrogenous Manures on One-year Seeds Hay, 1910 (*County Agric. Expt. Sta., Cockle Park, Northumberland, Bull. No.* 18, 1912).—Plots were top-dressed with nitrogenous manures (17½ lb. nitrogen per acre) and gave the following results per acre:—

Plot	Top Dressing	Cost	Cwt of Hay.
		s d	
1	None	—	$36\frac{1}{4}$
2	112 lb Nitrate of Soda	10 0	$41\frac{1}{2}$
3	134 lb ,, Lime	10 9	$46\frac{3}{4}$
4	87 lb Sulphate of Ammonia	10 3	$47\frac{1}{2}$

Nitrogenous Manures on Oats, 1910 and 1911 (*County Agric. Expt. Sta, Cockle Park, Northumberland, Bull. No.* 18, 1912).—The dressings and results per acre are shown in the following table —

Plot	Dressing	Cost	Yield.			
			1910 Grain	1910 Straw	1911 Grain	1911 Straw.
		s d	Bush	Cwt	Bush	Cwt
1	No Manure	—	34	$16\frac{3}{4}$	49	$25\frac{1}{4}$
2	112 lb Nitrate of Soda	10 0	43	$24\frac{1}{4}$	57	25
3	134 lb ,, Lime	10 9	$43\frac{1}{2}$	24	52	27
4	87 lb Sulphate of Ammonia	10 3	$38\frac{3}{4}$	24	59	$24\frac{1}{4}$
5	87 lb Nitrolim	8 7	$32\frac{3}{4}$	$18\frac{3}{4}$	$54\frac{1}{2}$	25

The dressings all contained $17\frac{1}{2}$ lb of nitrogen per acre

Nitrate of Lime and Nitrate of Soda on Oats, 1909 (*County Agric. Expt. Sta., Cockle Park, Northumberland, Bull. No.* 18, 1912) — Waverley oats were top-dressed, and the results were as follows —

Plot	Top Dressing	Cost	Yield	
			Grain	Straw
		s d	Bushels	Cwt.
1	None	—	31	13
2	112 lb Nitrate of Soda	10 0	38	$16\frac{3}{4}$
3	134 lb ,, Lime ...	10 9	$46\frac{3}{4}$	$23\frac{1}{4}$

FIELD CROPS

Varieties of Swedes and Turnips (*County Agric Expt. Sta, Cockle Park, Northumberland, Bull No.* 18, 1912)—The average yield over a number of years, and the average composition of several varieties of swedes and turnips are given. The average percentage of dry matter found in swedes during the past eleven years is also given. This percentage amounts at Cockle Park to practically 12. The swedes appeared to be richer in dry matter when summer frosts are not very prevalent.

Trials with Potatoes (*County Agric. Expt. Sta, Cockle Park, Northumberland, Bull No.* 18, 1912).—These trials were continued in 1911 and 1912. In past years it had been shown that potatoes should

not be grown for more than two years at Cockle Park without change of seed In 1911, however, two varieties, Cumberland Ideal and White City, proved exceptions. Conclusive evidence has been obtained during these extended experiments that at Cockle Park potatoes from Scotland or from the north of Ireland give considerably better results than those grown for more than one year at Cockle Park Potatoes from Berkshire have produced only a quarter of a crop. In trials to ascertain the best time of planting it has been found that the best results are obtained if the tubers are sown in February, provided the land is in a suitable condition Sprouting prior to planting has yielded increases of more than a ton of good potatoes per acre. This result was obtained with main crop and late varieties The results of the variety trials for 1912 are not given.

Experiments with Maize (*East Anglian Inst. of Agric, Chelmsford. Rept on Field Expts*, 1912).—*Varieties*.—The following varieties were tested —White Cap Yellow Dent, Longfellow, Angel of Midnight, Quebec Yellow, Champion White Pearl, Improved Leaming, Eureka, Wood's Northern Dent, White Horse Tooth, Giant Caragua. The first eight were Canadian and American seed The last two were purchased at Reading. The maize was ploughed in on May 16th. The seed was sown at the rate of two bushels per acre, and in rows 20 in apart A dressing of 10 tons dung, 1 cwt nitrate of soda, 3 cwt superphosphate, and ½ cwt sulphate of potash per acre was given.

The following conclusions were reached —

(1) Many of the above varieties are capable of producing a very heavy weight of fodder per acre. The yield as compared with 1911 showed a great increase, which was attributed to heavier rainfall and to better tilth.

(2) The first five varieties are fairly equal in cropping capacity, and did well both in 1911 and 1912.

(3) In 1911 Improved Leaming, Wood's Northern Dent, and Eureka gave the best yields, and they cropped well in 1912 also.

(4) The superiority of the Canadian and American seed in 1911 was not maintained in 1912.

(5) It is important to cut maize at the right time This seems to be just before the male flower fully appears from the sheath.

Distance Apart of Sowing.—Sutton's Early Prolific was sown with the rows at 24, 20, 16, and 8 in apart respectively. The experiment showed that (1) the largest crop is obtained from the narrowest rows, and (2) that rows at 20 in. apart are much more profitable than at 24 in.

It is pointed out, however, that in making rows closer than 20 in. other factors must be considered, namely, the large amount of seed required, and the difficulty of horse-hoeing, which is very important in a dry season.

Experiments with Helianthi in Hungary (*Deut. Landw. Presse, October 26th*, 1912)—Experiments with helianthi in Hungary seem to show that it is less valuable as a forage crop than the Jerusalem artichoke At the experiment station at Magyarovar, the yields obtained on a fertile humid clay soil were:—Helianthi, 2,820 lb. stems and leaves and 4,940 lb. tubers per acre, and Jerusalem artichokes, 7,410 lb. stems and leaves and 18,320 lb. tubers per acre. Half of the helianthi

plants failed, against only 7 per cent. of the Jerusalem artichokes, but even making allowance for this difference the yield of Jerusalem artichokes was greatly superior to that of helianthi The inferiority of helianthi was also demonstrated by pot experiments with various soils. A further disadvantage of helianthi was found in the difficulty of harvesting the tubers, spades having to be used on account of the long underground runners, while the tubers of the Jerusalem artichokes are close together, like those of the potato, and can be easily harvested with a hoe.

Experiments were also undertaken by various influential Hungarian farmers, and the report in each case as to the value of helianthi compared with Jerusalem artichokes was adverse It is concluded that helianthi may do well in certain circumstances, but that on the whole the results which have been ascribed to it had not been obtained.

POULTRY.

The Utility Poultry Club's Twelve Months' Laying Competition.—The competition has now been running for six months, and the figures for the sixth period, which ended on April 1st, are available

The position of the leading pens is as follows.—

Order	Pen No	Breed	Total Eggs for Six Months	Total Money Value £ s. d
1	86	Buff Rock	560	3 8 4
2	60	White Wyandotte	577	3 5 8
3	32	,, ,,	544	2 19 3
4	45	,, ,,	515	2 16 4
5	24	Black Leghorn	506	2 16 1
6	40	White Wyandotte	505	2 15 5
7	80	Buff Orpington	482	2 13 5
8	100	Red Sussex	460	2 12 7

The highest score of the month was secured by the Silver-laced Wyandottes in Pen 62, which produced 152 eggs of the value of 11s. 2¼*d*. Mild weather during the month has induced broodiness The general health of the birds has been good.

FORESTRY

Damping-off of Coniferous Seedlings (*Quart. Journ. of Forestry, October*, 1912)—In the United States, as in this country, seedling beds of young conifers are apt to be attacked by fungoid disease, more particularly by *Pythium debaryanum*, *Rhizoctonia* sp, and *Fusarium* sp. Experiments carried out in Nebraska on a light, sandy soil as to the value of various fungicidal agents in this connection, which are reported in this publication, are therefore of interest The fungicides were applied to the soil before sowing the seed, as well as to the seed beds after the plants had appeared above ground. Commercial sulphuric acid was found to be most effective; $\frac{3}{16}$ of a fluid ounce per sq. ft of soil surface were found sufficient to kill *Pythium* and *Rhizoctonia.* Formalin was about one-half as efficient, *i.e.*, ⅜ oz. would be required

per sq. ft. Slaked lime at the rate of ½ oz. per sq. ft. was ineffective, while ¾ oz. or more killed the seedlings of *P. banksiana.*

The degree to which the commercial sulphuric acid used was diluted was probably one part of acid to ten parts of water. It is applied a day or two before the seed is sown, and from the time that germination commences the beds have to be lightly watered with pure water twice a day, in order to prevent the acid in the soil becoming too concentrated, and thus injuring the seedlings. An additional result claimed for the treatment is that weeds are to a large extent destroyed.

Influence of Parent Trees on the Progeny (*Quart. Journ of Forestry, October.* 1912.)—Experiments carried out by Dr. Zederbauer on Scots pine at the State Forestry Experimental Station at Mariabrunn are summarised in this publication. It is concluded that :—

(1) Individual variations amongst trees depend partly upon the character of the situation and partly upon innate characteristics.

(2) The situation may emphasise or modify those characteristics but cannot obliterate them entirely.

(3) Seedlings from trees possessing open crowns are faster growing than those from trees with more compact crowns. The average height of the former type of seedling at six years of age was 3 ft 9 in., that of the latter 2 ft.

(4) The age of the seed tree had a perceptible influence upon the seedlings, which were about 6 in taller when raised from seed of young trees than when old trees of the same habit furnished the seed

(5) Seedlings raised from a vigorous, dominant Scots pine proved free from "leaf cast" (*Lophodermium pinastri*), while the seedlings from a partially suppressed tree of the same age were badly attacked.

Demonstration Forestry Plots at Cockle Park (*County Agric. Expt Sta., Cockle Park, Northumberland, Bull No* 18, 1912).—Ten plots were planted in 1898 and 1899 with a view to illustrating certain principles of sylviculture The 1912 report states that probably the most remarkable feature of the demonstration plots is the very successful growth of Japanese larch on poor clay soil They have not only far outgrown the European larch, but, so far, they are free from attack by aphis and larch canker, which is so prevalent on the common species. Another marked feature mentioned is the rapid growth of Sitka spruce as compared with the Norway spruce.

MISCELLANEOUS.

Loss of Efficiency in Arsenic Dipping Fluids (*Agric. Journ., Union of S. Africa, Jan.,* 1913).—Experimenters with sheep dips are agreed that sodium arsenate is much less efficacious as an insecticide than the corresponding arsenite, and the oxidation of sodium arsenite to sodium arsenate in dipping fluids is therefore a question of importance to owners of live-stock.

A series of laboratory investigations was conducted with the view of comparing the rates of oxidation in dips under varying conditions No oxidation whatever of the arsenite took place when the dip was made up with pure water, but the addition of excretory matter (such as would get into the dip on the farm) caused such rapid oxidation that within two months practically all the arsenite had disappeared The amount of total arsenic in the dips remained constant

Samples were also taken at intervals from a dipping tank in a field, the samples being allowed to stand in the laboratory, where they were analysed each month The sample taken when the mixture had been freshly made in the tank underwent only very slight oxidation on standing in the laboratory, owing, it is stated, to the fact that the fresh fluid must have been unfavourable to the development of the few bacteria present at the commencement

It was found that oxidation had proceeded fairly rapidly in the tank during the first month after mixing, and the first month's sample kept in the laboratory lost its arsenite in about four months.

Owing to very low temperatures being experienced in the second month, very little oxidation took place, and no further oxidation occurred in the second month's sample when kept in the laboratory The organisms in the dip had apparently all been killed by the cold weather With warmer weather the fluid in the tank again became infected

The author emphasises the importance of an analysis of the dip fluid being made as soon as it is prepared and thoroughly mixed in the tank, and considers also that, in view of the facts brought to light in these experiments, a periodical estimation of the arsenical contents of the dip is essential

NOTES ON AGRICULTURAL CO-OPERATION

The Tiverton Farmers' and Shire Horse Society.

This society is a co-operative society, which was registered under the Industrial and Provident Societies Act on January 14th, 1911, and affiliated to the Agricultural Organisation Society According to its rules, its object is, among other things, "to carry on the business of purchasing (or hiring) and maintaining pedigree live stock, and the hire of same to members for stud purposes" The shares are of the nominal value of £1, of which 5s. is payable on application, and the remainder in such calls as the committee may direct, they are transferable but not withdrawable; individual members must hold at least one share The payment of 5 per cent interest on the share capital is the first charge on the net profit, subject to the approval of the annual general meeting, and of the balance of the net profit at least one-half goes to the reserve fund

From the annual return for the year ending January 14th, 1913, it appears that there were then 87 members, and that 371 shares had been issued, on which £284 had been paid up The Society owns one Shire stallion, called "Amberley Duke," which cost the society £295, besides £24, the expenses of the selection committee; he is entered in the balance-sheet as still worth £295, and was passed as sound on January 17th, 1913, by the Board of Agriculture's examiner

According to the statement of accounts for the first year, ending January 14th, 1912, the income of the Society, other than share capital, in that year was £267 from service fees, and £20 donation, making, with a little interest, £287 in all Against this the expenditure was £192, including £59 stable expenses, £37 salaries and wages, and £35 for insurance, so that the profit and loss account of that year

showed a surplus of £96. For the second year, ending January 14th, 1913, the income was £287, including £285 from service fees, and the expenditure was £163, including £65 for stable expenses, £43 for salaries and wages, and £36 for insurance, so that the surplus of the year was £124. The balance-sheet for January 14th, 1913, shows the assets of the Society as being the stallion, valued at £295, and cash in the bank amounting to £208, making £503 altogether. Against this the only liability shown is the share capital due to shareholders, £284, so that the Society is in possession of a clear profit on its two years' working of £219 (or £199, if the donation of £20 be excluded); but, in view of the fact that no depreciation has been charged in reduction of the cost value of the stallion, it is possible some portion of the surplus may be absorbed if, on resale, the stallion fails to realise the amount stated In order to be in a position to meet such a loss should it occur, the Society has not yet paid a dividend, but held all profit in reserve

PROFIT AND LOSS ACCOUNT.

Expenditure.

	Stable Expenses £ s	Salaries and Wages £ s	Insurance £ s	Sundry £ s	Total £ s
1911	58 13	37 4	35 5	60 9	191 11
1912	67 13	43 19	35 11	15 12	162 15

PROFIT AND LOSS ACCOUNT.

Income.

	Service Fees £ s	Interest £ s	Donation £ s	Total £ s	Surplus £ s
1911	266 10	17	20 0	287 7	95 16
1912	284 10	2 4	—	286 14	123 19

The system of utilising the stallion is that he travels from about April 1st to about the middle of July, and is in use for only about four months in the year, during which a groom is employed at a salary of about £24, besides which he gets a fee of 2*s* 6*d*. per mare, payable by the owner of the mare. During the winter the stallion runs rough at a farm at a cost of £1 per week for keep and attendance.

A shareholder is entitled to one nomination for every two shares held by him, and, if necessary, preference between shareholders is decided by ballot The service fee for a member's nomination is £2 15s., or, if his mare was barren last season, £2; outsiders are charged £3 The total number of mares covered in 1911 was 101, and in 1912 110, giving an average per annum of 106 The total amount of fees received was £266 10s in 1911, and £284 10s. in 1912, which gives an average of £2 12s. per mare covered. The insurance of £32 on the horse not only covers a maximum loss of £350 at death by accident o disease, but also a disablement compensation of £10 a week, payable for ten weeks, to enable the Society to provide a temporary substitute for the horse when necessary. A sum of £3 is also paid for the insurance of the groom.

Judging from the experience of this one society, the owners of 100 mares might form a self-supporting society on subscribing a fully-paid-up share capital of £4 per mare, which would give them £300 to buy the stallion, and a sum to pay working expenses until service fees became payable. They might expect their annual expenses to be somewhat as follows.—

	£
Insurance	35
Stable expenses	70
Groom's wages	30
Cost of management	35
Annual depreciation of stallion at 20 per cent	60
Total	230

so that if the stallion, on the average, served 100 mares in the season, an average service fee of £2 10s. per mare ought to cover their expenses and keep them going, without the need of any further share capital As the £60 per annum allowed for depreciation would give them £180 in three years, they would be able to buy a new stallion every three years for £300, provided they could sell the old one for not less than £120

As the Tiverton Society has received on the average £2 12s. per service on 106 services per annum, its reserve fund is growing satisfactorily, and it seems likely soon to be in a position both to pay a moderate dividend on its share capital, and to reduce the service fee in accordance with co-operative principles Under this system of owning the stallion, however, there is the risk of the Society suffering a serious loss if the horse becomes permanently incapacitated as a sire before a large reserve fund has been accumulated, and it is interesting to compare the Society's recent experience as a stallion-owner with its previous experience in hiring stallions

During the eight years 1903 to 1910 the Society hired a horse each season, generally securing the services of one valued at about £400. The average amount paid for hire, groom, and travelling expenses was £261 per season, to which has to be added £15 for the average expenses of the selection committee, and £16 for the average working expenses, making a total average expenditure of £292 per annum Against this there was an average income of £240 from service fees, £7 in hire returned, and £5 from subscriptions, making an average income of £252 Thus on the average there was a loss of £40 per annum (£324 in all for the eight years), which had to be made up by levying special subscriptions from the members and their neighbours The service fees charged were generally £3 or £3 3s., a lower rate of £2 or £2 2s being charged for a mare barren in the previous year The average number of services was 87, so that the average income per service was £2 15s.

For the first five years the Society worked at a small profit, the accounts at the end of that period showing a balance to the good of £8. In those five years the average number of services was 105 per annum, while during the last three years the number of services averaged only 58, and this is evidently the chief reason why the Society suffered serious losses in these later years. The decrease in the number of services was chiefly due to the breaking down of the

TIVERTON AND DISTRICT SHIRE HORSE SOCIETY. HIRING SYSTEM.

	Expenditure						Receipts				Results of Year's Working	
Year	Selection Committee	Groom and Travelling	Hire	Sundries	Total	Number of Mares Served	Service Fees.	Abatement of Hire	Subscriptions	Total	Profit	Loss
	£	£	£	£ s	£ s		£ s	£	£	£ s	£ s	£ s
1903	19	92	220	7 0	338 0	112	336 0	—	—	336 0	—	2 0
1904	—	83	220	8 0	311 0	116	331 0	—	6	337 0	26 0	—
1905	23	—	250	16 0	289 0	100	270 10	—	5	275 10	—	13 10
1906	—	—	225	17 0	242 0	97	25[illegible] 10	—	5	256 10	14 10	—
1907	21	80	1[illegible]7	9 0	277 0	101	255 10	—	5	260 0	—	16 10
1908	27	—	275	35 7	337 10	44	119 14	60	5	184 14	—	152 13
1909	18	—	250	25 10	293 10	65	194 5	—	5	199 5	—	94 5
1910	10	—	225	13 15	248 15	64	158 15	—	5	163 15	—	85 0
Average	15	32	229	16 0	292 0	87	240 0	7	5	252 0	—	—

horses first selected, and to the failure of members to make a full use of the substitutes supplied.

There seems ground for hoping that now that the Society has a horse of its own, and that each member is directly interested in seeing that it is fully employed, similar losses will not recur, and that the accumulation of a large reserve fund, together with the system of insurance adopted, will soon place the Society in a satisfactory financial position.

Live Stock Insurance in Germany.

The two main branches of German live-stock insurance are life and slaughter insurance. By the former is meant the insurance of cattle-owners against loss by death or by compulsory slaughter; by slaughter insurance is meant insurance against loss arising through the condemnation of the whole or part of a carcass as unsuitable for human food. The latter branch of insurance has developed as a result of the stringent modern requirements as to the suitability of meat for human consumption The whole question of cattle life insurance has been greatly simplified by the veterinary measures adopted to prevent the introduction or extension of cattle disease, as well as by the circumstance that liability for compensation arising out of loss through the execution of these measures is taken over by the State Under the Imperial Cattle Diseases Act, which came into force in 1912, compensation for cattle affected with tuberculosis is now to be paid under certain conditions by the State Treasury

Cattle life insurance is mainly undertaken by small local societies, the number of which may be estimated at about 10,000; but the extent of their business is not even approximately known. Larger cattle-owners insure with large mutual cattle insurance societies At the end of 1909, 27 of these societies had policies outstanding in respect of 464,858 animals of a value of £10,333,000. German writers agree that this branch of insurance is little developed in Germany, and that small and medium holders, who have the greatest interest in insuring their stock, make the least use of insurance

No joint stock company is stated to undertake cattle life insurance in Germany It has been recognised by the authoritative agricultural organisations that life assurance is most suitably undertaken by local organisation of a mutual or co-operative character, through which effective valuation of animals, and effective supervision of animals when insured, and proper steps in case of anything occurring can be best carried out To meet the disadvantage of risk being borne by too limited a number of persons, and over too small an area, re-insurance is recommended

As to slaughter insurance, nine mutual societies in 1909 insured 1,838,548 animals to the value of £16,344,658, and seven commercial undertakings insured 880,403 animals for £5,615,872. Efforts made to establish an Imperial Cattle Slaughter Insurance Institution did not meet with success. In the kingdom of Saxony, however, compulsory slaughter insurance in respect of all cattle of over three months has been in force since 1900

The organisation of cattle insurance, both life and slaughter, has been taken up by the State in Baden and Bavaria. The latter has built its structure upon mutual and voluntarily formed local societies, which are offered the advantages of payment of half the compensation due when its model articles are adopted. Under the Baden Act of 1890 as finally amended in 1910, every communal authority is obliged to establish and administer a mutual cattle insurance institution when at a meeting of those cattle-owners resident within its area two-thirds of those present vote therefor, and their decision is ratified by the district authority. An important feature of both the Bavarian and Baden schemes is that the central organisation, after approval of the reports of the local units, pays, in the first instance, the full amount of the compensation due to insured persons, and recovers later the proportion due by these units on whose behalf payment was made. (*Report on Agricultural Credit and Agricultural Co-operation in Germany*, Cd 6626, price 5s)

OFFICIAL NOTICES AND CIRCULARS.

Handbook of British Breeds of Live Stock.

This Handbook was originally prepared for the Brussels and Buenos Aires International Exhibitions of 1910 with the special object of encouraging the export of British live stock. It has now been extensively revised, and it is hoped that it will prove of service to all who are interested in live stock, whether for exportation or otherwise

The first edition of the Handbook was compiled by Professor Wallace, of Edinburgh University, author of *Farm Live Stock of Great Britain* In preparing the second edition, attention has been given to various points of practical importance with a view to making the Handbook still more useful, and, in particular, attention may be drawn to some tables which are given showing the average ages, live weights and daily increases of cattle, sheep and pigs at the Smithfield Shows for the past ten years In the case of dairy cattle, milk yields have been given so far as they could be ascertained This information has not been previously published in this form, and it is thought that it will prove a useful guide to the relative size, weight and productive capabilities of the different breeds

Valuable information has also been supplied by the secretaries and councils of the various breed societies and of the Smithfield Club, who in many cases undertook the revision of the descriptions of their respective breeds A statement of the more important shows and places at which animals of each breed can be bought is given, together with an indication as to the average range of prices The Handbook now contains some 147 pages of letterpress, and 88 photographs of animals It may be obtained at the office of the Board, 8 Whitehall Place, London, S W , price 1s post free, or bound in cloth, 2s. post free

Harvest Weather Forecasts.

From June 1st to September 30th the Meteorological Office will, as in past years, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of the cost of the telegrams. The forecasts are drawn up each week-day at 2.30 p m., and refer to the probable weather during the fifteen hours from 6 a.m. to 9 p.m. on the next day. A note as to the further outlook is given when possible. Forecasts are also prepared at 9.30 a.m. and 7 p m., and can be sent in lieu of the afternoon telegrams on payment of 1s. 6*d*. per week for either service in addition to the cost of the telegrams.

Applications for the forecasts should be sent to the Director, Meteorological Office, South Kensington, London, S W , with a cheque or postal order to cover the cost of the telegrams for the period, which should not be less than six consecutive days, during which the forecasts are to be sent The telegrams are estimated to consist of sixteen words, exclusive of the address.

The office is also prepared to send notification by telegram of the expected commencement of spells of fine weather, and such further telegraphic notifications as may be necessary in order to keep the recipient informed of any further alterations, in the outlook For such a service a fee of 5*s*., which includes the cost of the telegrams, is payable in advance for each series of telegrams.

Report on Small Holdings for 1912.

Part I. of the Annual Report for 1912 of the Proceedings of the Board under the Small Holdings and Allotments Acts and various other land Acts has been recently issued [Cd 6770, price 5*d*] This Report is confined to the work of the Land Division of the Board during the past year with regard to Small Holdings; a feature of the Report which is perhaps especially interesting is the inclusion of a series of reports from successful small-holders on various types of holdings.

American Gooseberry Mildew Warning.

The Board of Agriculture and Fisheries received information that the summer stage of American Gooseberry Mildew (*Sphærotheca Mors uvæ*) was discovered in a Kent garden on April 14th, and in a Cambridgeshire garden on April 15th. All gooseberry growers are advised to examine their bushes carefully, and should any sign of disease be found, to spray their bushes with a solution of liver of sulphur (one pound to 32 gallons of water) A leaflet describing the disease and giving directions for dealing with it can be obtained from the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S W , gratis and post free. Letters so addressed need not be stamped

Growers are reminded that by Article 3 of the American Gooseberry Mildew Order of 1911 they are required to report the presence of this disease on their premises to the Board or the Clerk of the Local Authority for the district either directly or through an Inspector, and that the failure to report is punishable by a fine.

The Board have addressed the following Circular Letter, dated May 1st, 1913, to the Local Authorities in England and Wales for the purposes of the Fertilisers and Feeding Stuffs Act, 1906:—

Fertilisers and Feeding Stuffs Act, 1906.

SIR,

I am directed by the Board of Agriculture and Fisheries to say that they have had under consideration the question whether information obtained by Official Agricultural Analysts, in the analysis of samples of fertilisers and feeding stuffs under the above Act, could be utilised more effectively than at present

The Board do not suggest that any additional analytical work should be undertaken, but it appears to them that if particulars of the composition of samples analysed under the Act, so far as ascertained, could be regularly included by Agricultural Analysts in the Quarterly Reports made under Article 4 of the Fertilisers and Feeding Stuffs (General) Regulations, of 1906, the information thus placed at the Board's disposal would be of considerable value.

Many Agricultural Analysts, with whom the Board have at different times communicated on this subject, have for some time co-operated with the Board in the manner above indicated, and have stated in their Quarterly Reports the percentages of constituents found in samples to which the reports relates These particulars have been recorded and tabulated and have proved useful on many occasions.

With a view to facilitating the process of reporting details of analyses the Board have, after consultation with the Chief Agricultural Analyst and Official Agricultural Analysts, drawn up forms of report, for fertilisers and feeding stuffs, respectively, copies* of which are enclosed, and they will be glad to furnish further copies as required, or to receive the desired information in any other form analysts may prefer

I am to suggest that copies of this letter and of the enclosures should be supplied to the Official Agricultural Analyst for the district of your Local Authority, and these* are forwarded herewith accordingly

I am, &c ,

SYDNEY OLIVIER,

Secretary

The Production of Clean Milk on two Large Dairy Farms.

Mr R W Hobbs, of Kelmscott, Gloucestershire, wishes it to be stated that the estimate of the cost of keeping a herd of 40 dairy cows given in this *Journal* for February, 1913, p 926, in an article entitled "The Production of Clean Milk on Two Large Dairy Farms," does not relate to the Kelmscott herd of Messrs. R. W. Hobbs and Son, but was compiled by Mr R W. Hobbs about two years ago as an estimate of the cost of and return from a herd of 40 dairy cows.

* Not here printed.

Merklands Landing-place for Irish Animals. Tolls and Charges.

The Board of Agriculture and Fisheries have directed their Secretary, Sir Sydney Olivier, K.C.M.G., to hold a Public Inquiry on Thursday, the 22nd May, 1913, in the Borough Court Hall, Glasgow, at 11 o'clock, as to whether any of the tolls taken by the Corporation of Glasgow for the use of the Landing-Place for Irish Animals at Merklands may properly be reduced, regard being had to the expenditure and receipts of the Corporation in respect of the Landing-Place and to any money secured on the tolls and to the other circumstances of the case, and as to the charges which should be sanctioned by the Board under Article 6 of the Animals (Landing from Ireland) Order of 1913 for the use of the Landing-Place for animals landed under that Order.

Any persons or bodies desiring to be heard at the Inquiry are requested so to inform the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W., as soon as possible.

NAMES AND ROUTES OF THE KING'S PREMIUM STALLIONS.

Particulars of the Routes of the Stallions to which King's Premiums and Super-Premiums were awarded at the Show held at the Royal Agricultural Hall, Islington, London, N., on March 11th, 12th, and 13th, 1913, together with the names and addresses of the owners of the Stallions, and of the members of the Stallion Committees which have been appointed to supervise the service arrangements, are given below. The Routes are subject to some alteration by arrangement between the owners and the Stallion Committees.

The District Classes for England and Wales are as follows:—

District Class	Counties	Number of King's Premiums
I.	Durham Northumberland York, N. Riding	Three King's Premiums
II.	Cumberland Lancaster Westmorland	Four King's Premiums
III.	York, E. Riding York, W. Riding	Four King's Premiums
IV.	Lincoln, Parts of Holland ,, ,, ,, Kesteven ,, ,, ,, Lindsey Notts	Two King's Premiums

District Class	Counties	Number of King's Premiums
V	Derby ... Stafford	Two King's Premiums
VI	Chester Hereford Salop	Three King's Premiums
VII	Anglesey Cardigan Carnarvon Denbigh Flint Merioneth Montgomery	Two King's Premiums
VIII	Brecknock Carmarthen Glamorgan Monmouth Pembroke Radnor	Three King's Premiums
IX	Gloucester Oxford Warwick Worcester	Three King's Premiums
X	Bedford Hunts Leicester Northampton Rutland Soke of Peterboro	Three King's Premiums
XI	Cambs Isle of Ely Norfolk Suffolk	Two King's Premiums
XII	Bucks Essex Herts Middlesex	Two King's Premiums
XIII	Kent Surrey Sussex, East ,, West	Two King's Premiums
XIV	Berks Hants Isle of Wight	Two King's Premiums
XV	Dorset Somerset Wilts	Four King's Premiums.
XVI	Cornwall Devon	Three King's Premiums

District Class	Stalli	Free N Coi ıties to wl ıc allotted	Numbei allotted	Route	Stallion Committee
I	*** Wales,** The Lord Middle Birdsall, Malt	(N		Headquarters.—Birdsall . . Travels Malton, Pickering, Normanby, Salton, Ness, Hovingham, and Sheriff Hutton	Mr E Parsons, Birdsall, Malton Capt F Reynard, Camp Hill, Bedale Hon. T Willoughby, Hildenley Home Farm, Malton
	Rays Cross Mr W J Corbet Willbrook Hc Corofin, Co. Clare	No ımbe ınd		Headquarters —Alnwick Travels Doxford, Chatton, Turvelaws, Callaley, and Warkworth	Mr B. Clayhills, Dancing Hall, Whittingham. Mr J S Fawcus, Dunstan Steads, Lesbury. Mr G G Rea, Middleton, Wooler Mr R S Wright, Castle Estates Office, Alnwick
	Gold Medallist. Mr. S Mumford, Stud Farm, Moreton Morrell, Warwick			Headquarters —Sedgefield . Travels Castle Eden, Chester-le-Street, Newcastle, Ryton, and Lanchester	Mr F Bell, Northend, Durham Mr G Liddell, Kimblesworth Grange, Chester-le Street Mr. R Ord, Sands Hall, Sedgefield.
II	**Tydides.** Dr. A. O Haslewood, Fairfield Stud, Buxton	Cumberland		Headquarters —Wigton ... .. Travels Aspatria, Penrith, Kirkoswald, Brampton, Carlisle, Whitehaven, and Cockermouth	Mr G M Bell, 1, Lonsdale Street, Carlisle Mr R Edwin James, Manor House, Oughterside, Carlisle Mr W R Mounsey, 20, King Street, Penrith.
	Royal Bow. Messrs. Flannery Bros Churchtown, Buttevan Co.	Lai		Headquarters —Rochdale Travels Bolton, Chorley, Blackburn, Clitheroe, Haslingden, Accrington, and Burnley	Mr J Kerr Calderwood, M.R.C.V.S., Ingledale, Clitheroe Major H M Hardcastle, Bradshaw Hall, Bolton le-Moors Mr J T Pilling, The Thrums, Rochdale.

s the award of a Super-Premium

II. (*cont.*)	**Elector.** Mr. A McMahon, Colt Stud Farm, Abbeyleix, Queen's Co	Westmorland	25	Headquarters —Kendal ... ... Travels Temple Sowerby, Eden Valley, Askham, Shap, Kirkby Lonsdale, Middleton, Milnthorpe, and Windermere.	Mr E. D. McNaughton, Milnthorpe. Mr. G. G. Robinson, Underley Farm, Kirkby Lonsdale. Mr. T H. Walton, Windermere. Mr. R. Woof, Lowther, Penrith.
	Hon. Jummy. Mr W S. Ridehalgh, Broughton Lodge, Grange-over-Sands, Lancs	Lancashire	25	Headquarters — Grange - over - Sands ... Travels Cark, Ulverston, Dalton, Barrow, Carnforth, and Lancaster.	Mr. J. Blundell, Lower Barrow, Scotforth, Lancaster Mr. W. F. Egerton, Gawithfield, Ulverston. Mr. E. Whinnerah, Warton, Carnforth.
III.	***†King's Courtship.** Messrs. T L Wickham-Boynton, and H. A Cholmondeley, Burton Agnes, Driffield	York (East Riding)	25	Headquarters :—Burton Agnes Travels Bridlington, Driffield, and Hedon	Mr J S. Chubb, Sledmere, York. Mr. B. C. Pennington, Estate Office, Burton Agnes, Driffield Mr. F Reynard, Sunderlandwick, Driffield
	***‡Birk Gill.** Mr. E. H Barlow, Sigsworth, Pateley Bridge, Yorks	York (West Riding)	25	Headquarters :—Pateley Bridge ... Travels Ripley, Harrogate, Knaresborough, Wetherby, Boroughbridge, and Ripon.	Mr Hudson, Pannal, Harrogate. Mr B North, 31, Market Place, Ripon, Mr T Robinson, The Laurels, Wetherby
	***Kilbrook.** Messrs. E & P. Hodgson Riding Fields Stud, Beverley, Yorks	York (East Riding)	25	Headquarters —Beverley . Travels Lockington, Cranswick, Skirlaugh, Hessle, Swanland, and Bishop Burton.	Mr. E. C Bainton, Red House, Beverley Mr. J. Simons Harrison, Hurn Lodge, Beverley Mr F Reynard, Sunderlandwick, Driffield.

* Indicates award of a Super-Premium † Indicates award of King's Champion Challenge Cup.
‡ Indicates award of Reserve for King's Champion Challenge Cup

District Class	Stallion and Owner	Free Nominations: Counties to which allotted	Free Nominations: Number allotted	Route	Stallion Committee
III. (cont.)	**Dalnacrag.** Messrs T L Wickham-Boynton, and H A Cholmondley, Burton Agnes Driffield	York (East Riding)	25	Headquarters —Burton Agnes. Travels Howden, and Escrick	Mr B C Pennington, Estate Office, Burton Agnes, Driffield Mr E P Scholfield, Sand Hall, Howden Mr C W Thompson, Escrick, York
IV	**Akbar.** The Southwold Hunt Sire Association, Claythorpe Manor, Alford	Lincoln (parts of Lindsey)	25	Headquarters —Alford. Travels Louth, Brocklesby, and Horncastle	Mr H D Addey, Claythorpe Manor, Alford Mr E Crowder, Langton Manor, Horncastle Mr W B Swallow, The Lawn, Wootton, Ulceby
	Referendum II. Messrs C J C Hill, and E S Tomlinson, North Rauceby, Grantham	Lincoln (parts of Lindsey) Lincoln (parts of Kesteven)	10 15	Headquarters —Rauceby. Travels Sleaford, Scopwick, Lincoln, Claypole, Barrowby, and Grantham	Mr F A Holmes, M R C V S, Hemswell, Lincoln Mr G T Marriner, Scopwick, Lincoln Mr W Newton, Barrowby Old Hall, Grantham
V	**Ipswich.** Dr A O Haslewood, Fairfield Stud, Buxton	Derby	25	Headquarters —Buxton. Travels Bakewell, Derby, and Ashbourne	Mr S Burton Canal Office, Derby Messrs Hampson Bros, 3, The Quadrant, Buxton Mr A P Payne-Gallwey, Castle Hill, Bakewell
	King Grouse. Dr A O Haslewood Fairfield Stud, Buxton	Stafford.	25	Headquarters —Trentham. Travels Newcastle, Longton, Stone Longdon, Penkridge, Stafford, Eccleshall, and Whitmore	Mr W Blocklay, Moor Hall, Madeley, Newcastle, Staffs Mr R Carless, M.R C V S, Stafford Mr J W Coe, F R C V S, Stoke-on-Trent Mr J Keen, Hill Top, Longdon, Rugeley Mr E Woodcock, M R C V S, Eccleshall, Stafford

VI	**Bacton Lad.** Mr F W Barling, M R C V S Bartestree Court, Hereford	Hereford	25	Headquarters —Bartestree Travels Ledbury, Hereford, Ross, Leominster, and Bromyard	Mr J Bird Livers Ocle, Hereford Capt E L Hesgate, Buckland, Leominster Mr E H Landon, Bullingham, Hereford
	Christmas Greeting. Mr T J Hillman Stud Farm Stock Wood, Redditch	Salop	25	Headquarters —Shrewsbury Travels Market Drayton Whitchurch and Ellesmere	Mr T M Parker, M R C V S, Whitchurch Mr I Podmore Oakley Park, Market Drayton, Mr T Whitfield, 12, Talbot Chambers, Shrewsbury
	General Stossel. Mr S Mumford, Stud Farm, Moreton Morel, Warwick	Cheshire	25	Headquarters —Bunbury Travels Nantwich Crewe, Sandbach Warmingham, Waverton, Farndon Chester, Tarvin, and Tarporley	Mr J J Jersey de Knoop, Calveley Hall Tarporley Mr J W Macfie, Rowton Hall, Chester Mr B D Poole, Marbury Hall, Whitchurch
VII	***Neyland.** Messrs J F Rees M R C V S and W V Howell Thomas, 22 Lammas St Carmarthen	Cardigan	25	Headquarters —Aberystwyth Travels Tregaron Lampeter, Llandyssul, Newcastle Emlyn, and Cardigan	Lt-Col H W H Brenchley, Glaneirw, Cardigan Sir E J W P Pryse, Bart, Gogerddan Bow Street, Cardiganshire Mr R S Rowland The Garth Llanio Road, Cardiganshire
	Red Sahib. Mr D Davies, M P Broneirion, Llandinam, Mont	Montgomery	25	Headquarters Llandinam, Mont Travels Newtown, Kerry, Montgomery, Forden, Welshpool, Pool Quay, Llanymynech, Garthmyl, Abermule, and Llanidloes	Mr T Green Bank, Pool Quay, Welshpool Mr E C Morgan, Crown Chambers, High Street, Newtown Mr R Morgan, Snowfield, Kerry, Newtown Mr F R Owen, Nag's Head, Garthmyl, Montgomery

* Indicates the award of a Super-Premium

District Class	Stallion and Owner	Free Nominations: Counties to which allotted	Free Nominations: Number allotted	Route	Stallion Committee
VIII	**Captain Jack.** Messrs J F Rees, M R C V S, and W V Howell Thomas, 22 Lammas St, Carmarthen	Carmarthen	25	Headquarters —Carmarthen Travels Nantcaredig, Llanarthney, Dryslwyn, Llangadock, Llandilo, Kidwelly, St Clears, Whitland, Llanboidy, and Mydrim	Capt D C S Gwynne, Cilgwyn, Llangadock, Carmarthen Mr D G Protheroe, Glyntaf, Hebron, Carmarthen Mr D. H Thomas, Starling Park, Carmarthen
	Eglinton. Mr J Griffiths, Jameston Court, Manorbier, Pemb	Pembroke	25	Headquarters —Haverfordwest ... Travels Letterston, Narberth, and Pembroke	Mr T G Phelps, Cresselly, Begelly, Pembrokeshire Mr R H B. Summers, Summerville, Haverfordwest Mr J Walters, Southwood, Roch, Pembrokeshire
	Pedlar Brand. Mr D Davies, M P Broneirion, Llandinam, Mont	Glamorgan	25	Headquarters —Cowbridge Travels Barry, Cardiff, Caerphilly, Pontypridd, Llantrissant, Llantwit Major, Bridgend, Margam, Marcross, and Llisworney.	Col W Forrest, D S O, Plymouth Estate Offices, St Fagan's, Cardiff Col H R Homfray, Penllyn Castle, Cowbridge, Glam Mr G Lipscomb, Margam, Port Talbot Mr Iltyd Williams, Castleton, St Athan, Cardiff
IX	***Puro Caster.** Lord Willoughby de Broke, Compton Verney, Warwick	Warwick	25	Headquarters —Kineton Travels Wellesbourne, Hampton Lucy, Stratford-on-Avon, Oxhill, Fenny Compton, and Radway	Lord Willoughby de Broke, Compton Verney, Warwick Mr. C Kendal, Mount Pleasant, Walton, Warwick. Mr J Lea, Charlecote, Warwick. Mr J Wilkes, Tredington, Shipston-on-Stour

IX. (*cont.*)	**Freebooter.** The Compton Stud, Sandley, Gillingham, Dorset	Gloucester ...	25	Headquarters:—Gloucester. Travels Lydney, Berkeley Road, Chipping Sodbury, Tetbury, and Stroud	Mr M G Lloyd Baker, The Cottage, Hardwicke, Glos Major the Hon L Byng, Avening, Stroud, Glos. Col F Henry, Elmstree, Tetbury, Glos.
	Golden Petrel. Mr T. K Bickell, St John's Stud Farm, Lamerton, Tavistock	Worcester .. Warwick	15 10	Headquarters —Droitwich. Travels Worcester, Feckenham, Bromsgrove, Redditch, Henley-in-Arden, Warwick, Leamington Spa, Kenilworth and Coleshill	Mr J. P Arkwright, Hatton House, Hatton, Warwick Mr T M Burman, Bragg's Farm, Shirley, Birmingham Mr R Cottrill, Sandal Lodge, Droitwich Mr E Ringer, M R C V S, Guy Street, Leamington
X	**Drummond's Pride.** Mr R L Fenwick, Little Belvoir, Melton Mowbray	Leicester Rutland .	15 10	Headquarters —Little Belvoir. Travels Sixhills, Melton Mowbray, Oakham, Luffenham, and Stamford	Mr J F Cartmell Manor House, Kirby Bellars, Melton Mowbray Mr R C Cooper, Waltham, Melton Mowbray Mr E Guy Fenwick, North Luffenham Hall, Stamford Mr D Ward, Bescaby House, Melton Mowbray
	Gog Mr. J Drage, Chapel Brampton Northampton	Northampton Leicester	20 5	Headquarters —Chapel Brampton. Travels Northampton, Wellingborough, Kettering, and Market Harborough	Mr J Brown, Earls Barton House, Northampton Mr E Messinger, Chapel Brampton, Northampton Mr. H R. Roe, Cranoe, Market Harborough.
	Lord Harry. The Earl of Lonsdale, Barley Thorpe, Oakham	Rutland. . Northampton	10 15	Headquarters —Oakham. Travels Newnham, Daventry, Towcester, and Brackley	Mr W Murland, Badby House, Daventry. Mr W. George, Gayton, Blisworth, Northants. Mr J G. Lawrence, Newnham, Daventry Mr G Underwood, Barley Thorpe, Oakham

* Indicates the award of a Super-Premium

District Class	Stallion and Owner	Free Nominations: Counties to which allotted	Free Nominations: Number allotted	Route	Stallion Committee
XI	***Ulpian.** Messrs E H Barlow, and D Fraser, Sigsworth, Pateley Bridge, Yorks	Suffolk .	25	Headquarters —Hasketon, Woodbridge Travels Ipswich, Manningtree, Stowmarket, and Saxmundham	Mr J Keeble, Brantham Hall, Manningtree Mr R E Walford, Hasketon, Woodbridge, Mr F Stearn, Old Newton, Stowmarket
	Sea Bath. The Exors of the late Mr R W Palmer, Swafield House Stud Farm, North Walsham	Norfolk... ..	25	Headquarters —Swafield Travels Aylsham Norwich, Wymondham, and Fakenham	Mr J Barclay, Aylsham Mr C F Gurney, Caister Old Hall, Norwich Mr T O Springfield, Alburgh House, Harleston
XII	***Stortford.** Sir Walter Gilbey, Bart , Elsenham Hall, Stansted, Essex	Essex	25	Headquarters —Elsenham Travels Takely, The Rodings, Good Easter Ongar, Blackmore Chelmsford, and Braintree	Mr T Christy, Roxwell, Chelmsford Mr G A Newman Panfield Hall, Braintree, Mr H Starling, The Paddocks, Elsenham
	Indian Runner Mr D. Fraser, Tickford Park. Newport Pagnell	Buckingham . .	25	Headquarters —Newport Pagnell Travels Cosgrove, Hanslope, Stony Stratford, Buckingham, and Fenny Stratford	Mr F W Coales, Lathbury, Newport Pagnell., Mr M Grimes, Tickford Park Stud, Newport Pagnell Mr C D Pennant. Lillingstone Dayrell, Buckingham
XIII.	***Hanover Square.** Sir Merrik R Burrell, Bt , Knepp Castle, Horsham	Sussex (West)	25	Headquarters — Knepp Castle, Horsham Travels West Grinstead, Steyning, Washington, Storrington, Petworth, and Billingshurst	Mr E Brown, Stud Farm, Knepp Castle, Horsham Mr A G Hecks, Manor Farm, Sullington, Pulborough Mr J. B Watson, Estate Office, Petworth.

XIII (*con'.*)	**Rockaway.** Mr. C Kelway-Bamber, Priestlands, Horley, Surrey	Surrey Kent	10 15	Headquarters —Horley Travels East Grinstead, Tunbridge Wells, Tonbridge, Sevenoaks, Maidstone, and Redhill	Mr G. C G Leveson Gower, Titsey Place, Limpsfield, Surrey Mr W. G Lambarde Bradbourne, Hall, Sevenoaks Mr C Murdoch, Wester Hill, Linton, Maidstone Mr E Murray, M F H, The Old Cottage, Mickleham, Dorking
XIV	**Crathorne.** The Lord Middleton, Bidsall, Malton	Berks ...	25	Headquarters —Wantage Travels Abingdon, Kingston Bagpuze, Shrivenham, and Faringdon	Col G C Ricardo, Donnington, Newbury Major H G Henderson, M P, Kitemore, Faringdon Mr E Robson, Stockham, Wantage
	Territorial. The Compton Stud, Sandley Gillingham, Dorset	Hants ...	25	Headquarters —Dummer Travels Alresford, Alton, Basingstoke, Ecchinswell, and Whitchurch	Mr J F Complin, Holybourne, Alton Mr F Coryton, The Manor House, Greatham, Liss, Hants Mr H Dyson, Priory Farm, Charter Alley, Basingstoke Capt E P E Jervoise, The Manor House, Medstead, Alton Colonel B P Portal, J P, Laverstoke House, Whitchurch Sir Richard Rycroft, Bart, Dummer House, Basingstoke
XV	**Bird of Paradise.** Mr T. K. Bickell, St John's Stud Farm, Lamerton, Tavistock	Somerset ...	25	Headquarters —Wellington Travels Chard, Crewkerne, Yeovil, Bridgwater, and Taunton.	Mr M J C Hally, M R C V S, Wellington, Somerset Mr C L Hancock, Manor House, Cothelstone, Bishops Lydeard, Taunton Mr Basil Syres, Holyrood House, Chard

* Indicates the award of a Super-Premium.

District Class	Stallion and Owner	Free Nominations: Counties to which allotted	Free Nominations: Number allotted.	Route	Stallion Committee
XV (*cont.*)	**Fitz Donovan.** The Compton Stud, Sandley, Gillingham, Dorset	Wilts	25	Headquarters —Chippenham. Travels Melksham, Westbury, Devizes, and Calne	Mr H Mann, Semington, Trowbridge Mr W L Lysley, Notton, Lacock, Chippenham Mr V T Taylor, Steinbrook House, Chippenham.
	Zorzal. The Compton Stud, Sandley, Gillingham Dorset	Somerset	25	Headquarters —Taunton Travels Curry Rivel, Kingsdon Glastonbury, Highbridge, and Kewstoke	Capt M Boyle, Staple Fitzpaine Manor, Taunton Capt G Phipps Hornby, Somerton Erleigh, Somerton Mr T F Neal, Kingsdon, Taunton
	Thistledown. The Compton Stud, Sandley, Gillingham, Dorset	Somerset .. Dorset	15 10	Headquarters —Sandley Travels, Yeovil, Frome, and Shepton Mallet	Mr A C Clarke, Red Lion Hotel, Shepton Mallet Capt G Phipps Hornby, Somerton Erleigh, Somerton Major A L Langman, C M G, North Cadbury, Bath
XVI	***Golden Grebe.** Messrs W & H Whitley, Primley Farm, Paignton	Devon ... Cornwall ..	10 15	Headquarters —Paignton Travels Totnes, Liskeard, Bodmin, Plympton, Ivybridge, and Brent.	Mr C Burleigh, Caldrenick Farm, Menheniot, Liskeard Mr E. W Hawker, The Chantry, Ivybridge. Mr A Hingston, Jnr, Totnes.

District Class	Stallion and Owner	Free Nominations: Counties to which allotted	Free Nominations: Number allotted	Route	Stallion Committee
XVI (cont.)	**Marzio.** Mr. M. J. Taylor, Ermington, Ivybridge, Devon	Devon	25	Headquarters.—Ermington. Travels Newton Abbot, Dawlish, Exeter, Crediton, Tiverton, and Dulverton.	Major L. C. Garratt, Clyst St. Mary, Exeter. The Hon. H. B. Money-Coutts, Stocdleigh Court, Tiverton. Mr. W. H. Worrall, Clyst St. Mary, Exeter.
	Kano. Messrs. T. Yelverton & Sons, Otter Vale Stud, Venn Ottery, Ottery St. Mary, Devon	Devon	25	Headquarters.—Venn Ottery. Travels Axminster, Seaton Junction, Honiton, and Ottery St. Mary.	Mr. R. J. Broom, West End, Honiton. Mr. W. Marshall, Longfield Park, Sidmouth Junction. Mr. W. B. Nelder, F.R.C.V.S., 33, Paul Street, Exeter.

* Indicates the award of a Super-Premium.

MISCELLANEOUS NOTES

Importation of Nursery Stock, &c., into the United States.—The regulations made by the Secretary of the United States Department of Agriculture with regard to the importation into the United States of nursery stock, &c., were given in this *Journal* for December, 1912, p. 780. Amending regulations published in *Treasury Decisions* No. 3, 1912, provide that, after July 1st, 1912, a copy of the certificate required for the *entry of nursery stock* must accompany each package, &c., of nursery stock, and that the original certificate must accompany the invoice for the consignment. Prior to July 1st, 1913, it will not be required that the original certificate of inspection shall accompany the invoice, but each package, &c., of imported nursery stock must bear a copy of the certificate of inspection. The original certificate must be signed and sealed by, and the copy certificate must bear the seal of, the responsible inspection official of the country of origin.

Importation Regulations.

It is also provided that the inspection of nursery stock shipped to the United States during the growing season must be made at the time of packing. On and after July 1st, 1913, nursery stock from countries which do not maintain official nursery-stock inspection will be admitted into the United States only for experimental purposes and in limited quantities. For such importations a special permit will be required.

Importation of Seeds, Plants, &c., into Uruguay.—With reference to the note on this subject which appeared in the *Journal* for November, 1912, p. 695, a Presidential Decree provides that the importation of seeds, plants, manures, &c., into Uruguay, may be effected through the ports of Salto and Colonia, in addition to Montevideo. *(Board of Trade Journal*, April 17th, 1913.)

Norwegian Method of Drying Hay.—A note was given in this *Journal* for May, 1907, p. 417, of a method employed for drying hay in central and northern Sweden, where the season is apt to be very wet at the time of hay harvest. The following account of this method as used in Norway, and which might be worth a trial in this country in a wet season, is given in a report by H. M. Consul at Christiania (*F. O. Repts., Annual Series*, No. 5018):—

Notes on Agriculture Abroad.

"As the hay is mown, rows of stakes, placed about 6 ft. apart and some 6 or 7 ft. high, are firmly erected in the hayfield. The distance apart of these rows, called *hesjer*, is determined by the closeness of the crop, the lie of the ground, and the aspect and prevailing winds, so as to facilitate the free percolation of air and sun through the hay, which is hung as it is mown, in swathes, across rails, twine or even wire placed on pegs from post to post at intervals of about 1 ft. to 18 in. from the ground. The hay is left to dry and is carried, without any shaking out or turning or making into haycocks, direct from the *hesjer*. Some little experience may be necessary in securely packing the

swathes of green grass, especially if short, on the transverse rails or lines, particularly when there are high winds; but this can with practice be done even by girls and women as the cutting proceeds. The advantages of the system are the saving of labour in "making" the hay, which "makes" itself on the *hesjer* owing to the free passage of air and sunshine, and the fact that the top swathes of hay form a kind of thatch or protection to shoot rain off the lower swathes, which escape the damp and dew owing to their being off the ground. The chief drawbacks, in the opinion of those I have questioned, to the system, are thought to be that the hay may lose somewhat in colour, and may occasionally even be too dry when it is brought to the stack. But these drawbacks would probably be outweighed by the advantages of the hay being fit to carry at once in a wet season if only a day or two of fine weather intervened. As already stated, in Norway the supports of the *hesjer* are usually of wood."

Demand for English Poultry in Switzerland.—The Commercial Intelligence Branch of the Board of Trade is informed that there is a demand in Switzerland for high-class English poultry. It appears that very few poultry are kept in that country, although the consumption of eggs and poultry is very great owing to the large number of visitors. As a consequence, great quantities of these commodities have to be imported, the better qualities mostly arriving from France and the inferior qualities from Italy. So far as the former are concerned, an increased demand has not been met by larger supplies. The season of greatest demand extends from July to October, the time when the birds are plentiful and prices are falling in the English market. Some trial shipments of Sussex chickens were sent to Switzerland last summer, and when the consignments arrived in good condition, the purchasers found they were superior to all others, and expressed a desire that more should be available It was found, however, that the method of killing adopted led to rapid deterioration in hot weather, and that, therefore, the exporters ran great risk of loss. It is advised that the fowls should be killed by "paletting," then finger drawn, and finally thoroughly cooked, as they would be from two to four days in transit; further, that the birds be graded, wrapped in parchment paper, and delivered to the shippers in London in cases each holding two or three dozen (*Board of Trade Journal*, April 17th, 1913.)

Cattle Industry in Brazil.—The following information relative to the cattle industry of Brazil is from the report by the Acting British Consul-General at Rio de Janeiro (Mr. E Hambloch) on the trade of that district in 1911 and 1912 -

Brazilian cattle weigh on an average 250 kilogs (551 lb) each. The price of cattle varies from 60 to 125 milreis (£4 to £8 6*s* 8*d*), and the average prices are from 80 to 100 milreis (£5 6*s*. 8*d*. to £6 13*s* 4*d*).

There is evidence that the State Governments are awaking to the possibilities of the cattle industry, and that grants for the importation of animals, which have recently decreased, may again be augmented. The moment would therefore seem propitious for British breeders to give their attention to the Brazilian market.

A large company is planning the construction of a big cold storage plant at São Paulo, and the establishment of breeding farms in Goyaz

and Matto Grosso, as well as in various other States of the south of Brazil This company is stated to have acquired 9,000,000 acres of cattle-raising land in the interior, and to intend to export frozen meat to Europe in its own steamships, fitted with refrigerating machinery The best strains of Hereford and Durham cattle are to be imported to improve the South American stock, which must necessarily be used at the outset. Hogs are also to be raised. (*Board of Trade Journal,* April 3rd, 1913.)

Congress on Food Adulteration.—An International Congress on the deterioration and adulteration of foodstuffs will be held at Ghent on August 1st–3rd, 1913, in connection with the International Exhibition. The subscription entitling to the membership of the Congress is 10 francs. Full particulars may be obtained from the Secretary of the Congress, M. Antony Neuckens, Hôtel de Ville, Brussels

Third International Congress of Refrigeration.—The Board have been informed that it is proposed to hold the third International Congress of Refrigeration in Chicago in September, 1913. The Congress will be formally opened in Washington on September 15th, but the business sessions will be held in Chicago from the 17th to the 24th of that month

An Exhibition will be held at Chicago in conjunction with the Congress Exhibits of refrigerator cars, pre-cooling systems, machinery installations, and operating exhibits, illustrating various methods in the manufacture of ice and the application of refrigeration in the arts and industries, as well as exhibits of machinery, materials, &c., are expected.

A portion of the Exhibition will be devoted to an Educational Food Exhibit, to be made by the United States Department of Agriculture, and to commercial exhibits of perishable foods of all kinds under refrigeration Exhibits from foreign countries are desired.

International Urban Exhibition at Lyons, 1914.—An International Urban Exhibition will be held at Lyons from May 1st to November 1st, 1914, under the patronage of the French Ministries for Foreign Affairs and for Commerce and Industry. The sections which will be of interest to agriculturists are those on foodstuffs of animal origin, milk and dairy produce, foodstuffs of vegetable origin, beverages, adulteration of food, veterinary education, co-operation, diseases of animals and plants, the control of tuberculosis, and horticulture. Foreign exhibits are invited

The Weather in England during April.

District	Temperature. Daily Mean	Temperature. Diff from Average	Rainfall. Amount	Rainfall. Diff. from Average	Rainfall. Number of Days with Rain.	Bright Sunshine. Daily Mean	Bright Sunshine. Diff from Average
	°	°	Inches	Inches		Hours	Hours.
Week ending Apr 5th							
England, N E	44 0	+1 5	0 21	-0·17	2	4·3	-0 7
England, E.	45 3	+1·5	0 32	-0 02	2	3 4	-1 7
Midland Counties	44 6	+0 8	0 24	-0·17	3	3 5	-1 2
England, S E	46 1	+0 9	0 47	+0 15	4	3 9	-1 1
England, N.W	45 1	+1 4	0·20	-0·32	2	4 9	+0 8
England, S W	45·8	+0·5	0 49	-0 05	4	5 2	+0 1
English Channel	47·6	0 0	0 38	-0·04	4	4 6	-1 4
Week ending Apr 12th							
England, N E ...	40 8	-2 6	0 54	+0 19	4	1·7	-3 3
England, E	41 5	-3 1	0 64	+0 27	4	2·5	-2 9
Midland Counties	41·8	-2 8	0·51	+0 11	3	2 2	-2 5
England, S.E	43 1	-2 9	0 44	+0 11	3	2 9	-2 3
England, N W.	43 2	-1 4	0 43	-0 04	3	2·8	-1 9
England, S W	44·4	-1·9	0 18	-0 32	2	3 1	-2 2
English Channel	46·6	-1·6	0·03	0 39	1	3·3	-2 9
Week ending Apr 19th							
England, N E	43 8	-0 7	0 45	+0 09	5	4·7	-0 2
England, E	43·7	-2 1	0 55	+0 19	6	4 3	-0 8
Midland Counties	43·8	-2 0	0 87	+0 47	6	4 4	-0 4
England, S E	44 7	-2 3	0 59	+0 19	5	4·7	-0 6
England, N W.	44 4	-1 4	1 18	+0 73	6	4·3	-0 8
England, S.W.	45 1	-1 8	1 45	+0 91	5	4·1	-1 4
English Channel	47 5	-1·4	1 02	+0 55	6	4 6	-1 8
Week ending Apr. 26th							
England, N E.	47·8	+1 9	0 33	-0 04	4	5·5	+0 2
England, E	48 8	+1 6	0 22	-0 17	3	6 6	+1 0
Midland Counties	49 1	+1 8	0·58	+0·14	5	4 9	-0 2
England, S E. .	49 7	+1 3	0·68	+0 22	5	6·2	+0 5
England, N W.	49 2	+2 1	0 93	+0 43	4	4·1	-1 1
England, S.W	49 1	+1·0	1·60	+0·98	6	3 7	-2 0
English Channel	50 3	+0 4	1·01	+0 49	5	5 5	-1 2

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for April, 1913, issued by the International Institute of Agriculture, gives the condition of winter cereals on 1st April as follows (100 being taken to represent the prospect of an average crop) .—*Wheat* —Denmark, 91; Spain, 93; Scotland, 100; Luxemburg, 110; Roumania, 120; Switzerland, 94; United States, 106; Japan, 106; Lower Egypt, 103; Upper Egypt, 100; Tunis, 130. *Rye*.—Denmark, 95; Spain, 93; Luxemburg, 108; Roumania, 120; Switzerland, 95; United States, 99. *Barley*.—Spain, 93; Luxemburg, 130; Roumania, 120; Switzerland, 94; Japan, 98; Lower Egypt, 99; Upper Egypt, 100; Tunis, 120. *Oats*.—Spain, 93; Tunis, 110. In Germany the condition of the crops on 1st April, expressed according to the system of notation of the country (1=very good, 2=good, 3=average, 4=bad, 5=very bad), was as follows:—Wheat, 2·7; rye, 2·7. In Austria the condition expressed on the same system was:—Wheat, 2·8; rye, 2·8.

Denmark.—The production of wheat in 1912 amounted to 452,000 qr., a decrease of 19 1 per cent. as compared with 1911. Rye showed a decrease of 4 2 per cent., the total production being 2,204,000 qr. Barley amounted to 2,997,000 qr., and oats to 5,313,000 qr., both being greater than in 1911, the former by 8 5 per cent. and the latter by 3·0 per cent.

Norway —The production of wheat in 1912 is placed at 41,000 qr., which is equal to an increase of 22·5 per cent. on 1911 Rye showed an increase of 9·9 per cent., barley of 21 0 per cent., and oats of 32·7 per cent., the productions being :—Rye, 121,000 qr.; barley, 300,000 qr.; and oats, 1,387,000 qr.

Tunis —The production of wheat in 1912 was less than half that of 1911, the amount being 482,000 qr., or 44 7 per cent. of the 1911 production. Barley only amounted to 23 1 per cent of the 1911 figure, the production being 369,000 qr Oats was also a poor crop, and amounted to 254,000 qr , which is equal to 53 3 per cent. of the production of 1911.

Hungary.—The report of the Ministry of Agriculture on the state of the crops on the 7th April states that, on the eve of publication, reports of a severe and unexpected frost were received from all parts of the country, especially from the Danube and the upper Theiss districts, the damage done by which it was then impossible to estimate. The mild and dry weather which had prevailed until April 7th had everywhere facilitated agricultural operations As there was ample time to prepare the land, and the soil was in a favourable condition, cereals were sown at the normal time. In some districts the planting of potatoes and maize has already commenced. The work of weeding, harrowing, and rolling autumn crops is finished. Damaged autumn crops have been replaced by spring corn, which has germinated well and developed rapidly under the influence of favourable weather. In several districts, however, plants on sandy soil already require rain Early sown autumn cereals have wintered well, but the later sown suffered from frosts, and in many places became so thin and patchy that resowing with spring corn was necessary Meadows, clover, and lucerne are in excellent condition.

Russia.—H M Vice-Consul at Nicolaieff, in a report dated April 19th, states that, except in the extreme north, spring sowing had been completed throughout his district (comprising the Governments of Kherson, Kharkov, Poltava, Kieff, Ekaterinoslav, and Taurida) The seed was sown under the most favourable conditions, and during the last few days, after a month of fine dry weather, rain had fallen everywhere. The young plants were strong and had made good growth. With a great reserve of moisture in the soil, with the surface well watered by the rains of the last few days, and with an early season, the prospects were as good as could be desired

Roumania.—The German Consul at Bucharest, in a report dated April 15th, states that the very heavy rainfall of last autumn, from August to November, hindered to an unusual extent the sowing of wheat, the area under which this year is therefore much smaller than in normal years. It is officially estimated at 3,852,207 acres, compared with 5,039,002 acres in 1911. The area under rye is estimated at 207,801 acres, compared with 280,382 acres, under barley at 109,495

acres, compared with 90,387 acres, and under rape at 246,150 acres, compared with 207,117 acres in 1911. As a result of the mild winter and the abundant rainfall, the crops have developed well and are in excellent condition. The prospects for wheat are good if the present drought does not continue. Rye, the area under which decreases year by year, promises a good yield. Rape seed is badly in need of rain. Spring sowing commenced in favourable circumstances. The oats, barley, peas, &c., sown in February looked very well at first, but have subsequently been much injured by unfavourable weather. For an improvement in the condition of the crops and in order that maize may be sown at the right time, warm showery weather is absolutely necessary. (*Deutscher Reichsanzeiger,* April 22nd.)

Canada.—A bulletin issued on April 17th by the Census and Statistics Office at Ottawa states that 92 per cent. of last year's wheat crop (199,236,000 bushels) was of marketable quality. Of the 361,733,000 bushels of oats 91 per cent., and of the 44,014,000 bushels of barley 87 per cent. was of marketable quality. The marketable yield of maize was 76 per cent. It is estimated that 22 per cent. of the wheat crop, 44.22 per cent. of the oat, and 35 per cent. of the barley remained in farmers' hands on March 31st.

Indications at the end of March were for an early sowing season throughout Eastern Canada. In the North-west Province, however, owing to recent deep snows and severe cold, a late season is anticipated. With few exceptions winter wheat in Southern Ontario was reported to be in fine condition.

United States.—The Department of Agriculture, reporting on crop conditions on May 1st, estimates the average condition of winter wheat at 91.9 per cent. compared with 91.6 per cent. on April 1st, 79.7 per cent. on May 1st, 1912, 85.6 per cent. being the ten years' average. The area still under the crop is estimated at 30,938,000 acres as against 25,744,000 acres at the same time last year, while the area abandoned is estimated at 1,449,000 acres compared with 6,469,000 acres last year. Of the total acreage of spring ploughing contemplated, 67.2 per cent. had been done compared with 52.8 per cent. last year. The area already planted with spring wheat is returned at 57.0 per cent. compared with 48.9 per cent. in 1912. The average condition of winter rye is estimated at 91.0 per cent., compared with 89.3 per cent. on April 1st and 86.5 per cent. on May 1st, 1912. (Broomhall, May 8th.)

Argentina.—The *Buenos Aires Handels-Zeitung* of the 5th April states that reports on the crops from the northern maize zone are, on the whole, favourable, and fully come up to expectations, the yield being about 70 per cent. of last year's record yield. The quality, on the whole, is satisfactory, the grain, although generally somewhat small, being ripe and good. From the southern maize zone reports are less favourable; the yield is on an average very poor, and the crop often a complete failure. (*Dornbusch,* April 28th.)

Live Stock in South Africa.—H.M. Trade Commissioner for South Africa reports that recently published census statistics show that the numbers of various classes of live stock in the Union were as follows:—5,796,949 cattle, 719,414 horses, 430,641 mules and donkeys, 30,656,659 sheep, 11,762,979 goats, 1,081,600 pigs, and 10,533,909 poultry. (*Board of Trade Journal,* April 24th.)

Unit Prices of Artificial Manures. Statement of cost to the purchaser of 1 per cent. per ton of Nitrogen, Soluble and Insoluble Phosphates, and Potash derived from

	Bristol.	Hull.	King's Lynn.	Liverpool
	s. d.	*s. d.*	*s. d*	*s. d.*
Nitrogen from :				
Sulphate of Ammonia 90% pure	14 8	15 8	14 6	14 6
Calcium Cyanamide ...	11 9½	—	12 3	11 9½
Nitrate of Soda pure 95%	16 1½	—	15 6½	15 0
Nitrate of Soda pure 90%	—	16 5½	—	15 9
Nitrate of Lime ...	15 6	—	16 0	14 6
Soluble Phosphates from:				
Superphosphate 35%	1 9½	1 8½	1 7½	1 9½
" 33%	—	—	—	—
" 30%	—	—	—	—
" 26%	1 11½	1 10	1 9	1 11
Dissolved Bones ...	4 2	—	—	3 1
Allowed for Insol. Phos.	*1 4½*	—	—	*1 4*
Allowed for Nitrogen	*16 1½*	—	—	*20 0*
Insoluble Phosphates from :				
Basic Slag	—	—	—	1 4
Bone Meal	1 4½	1 6	1 6	1 3
Allowed for Nitrogen ..	*15 2*	*15 8*	*15 9*	*18 9*
Steamed Bone Flour ...	1 4½	1 6½	1 6	1 4
Allowed for Nitrogen ..	*15 2*	*15 8*	*15 9*	*15 5*
Potash from ·				
Kainit	4 4½	—	3 10	4 4½
Sulphate of Potash ...	4 10½	—	4 4	4 6
Muriate of Potash... ...	4 2	—	3 7	3 10½
Potash Salts	—	—	—	3 9

NOTE.—These unit prices are based on the probable retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified. They are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the per-

various sources, at certain Ports and Manufacturing Centres, for May, 1913.

London.	Newcastle.	Newport.	Plymouth.	Silloth.	Widnes.
s. d.	*s d*	*s. d.*	*s. d*	*s. d.*	*s. d.*
15 0	14 7½	15 4½	15 2½	14 7	14 6
12 6	—	11 11½	11 9½	—	—
—	15 6½	16 6	15 10½	15 10½	15 0
16 6	—	—	—	—	15 9
15 9	—	15 6	15 6	—	—
1 9	1 10½	1 10	1 10	1 10½	1 9
—	—	—	1 10	—	—
—	—	—	1 10½	—	—
1 10	2 0½	2 0	2 0	2 2	1 10
2 6	3 4½	4 0	5 2	3 2	3 0
1 9	*1 3½*	*1 4*	*1 3½*	*1 7½*	*1 3*
20 0	*15 6½*	*16 0*	*15 10½*	*15 10½*	*20 0*
1 3	—	1 4	1 3½	—	—
1 7	1 3½	1 5	1 7½	1 7½	1 3
16 0	*14 7½*	*15 2*	*15 2½*	*14 7*	*18 9*
1 7	—	1 2½	1 7	1 5	1 3
16 0	—	*15 2*	*15 2½*	*14 7*	*18 9*
4 3	4 0	4 4½	4 4½	4 4½	4 5½
4 9	4 4½	4 9	4 10	4 10	4 0½
4 0	3 6	—	4 2	4 4½	4 0½
—	—	—	—	—	—

centages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, bags, and loss of weight.

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on the 1st May, report that the wet weather, which prevailed during most of the month, has very generally retarded field work. On heavy wet lands, wheat has had difficulty in maintaining its condition, but, on the whole, the crops already in the ground look fairly satisfactory.

Agricultural Conditions in England and Wales on May 1st.

Wheat continues to look healthy, with the exception of that which was sown late or upon land which was flooded during the winter. As regards the spring crops, a considerable area still remained to be sown at the end of the month in many districts all over the country, so that the season is in this respect very late. Where the plants had come up, they were nearly everywhere looking healthy and quite satisfactory. Beans and peas are also most satisfactory, particularly the former.

Potato planting was well advanced in most parts of the east of the country, except on heavy lands, and the work had then been done mostly under favourable conditions; but the rest of the country is much more behindhand, owing to the hindrance caused by the constant wet, and in many parts planting had hardly begun by the 1st May. Good progress was, however, general south of the Thames.

Planting of mangolds was also very backward, and material progress had practically only been made on light lands: in this case also, wet weather was the cause of the delay.

Fruit blossom, both in orchards and on bushes, was everywhere abundant, and prospects were generally very favourable for good crops. In districts where frosts had occurred about the middle of the month, reporters reserved judgment as to the possible effect of the frosts, more particularly upon plums.

"Seeds" are everywhere, with few exceptions, a flourishing and luxuriant crop, and with suitable weather should yield abundantly. Indeed, in some districts, particularly in the eastern half of the country, some reporters look for one of the heaviest crops on record. The few exceptions alluded to refer to cases where, owing to exceptional wet, some clover has perished.

Pastures were in many cases checked by the cool weather during the month, but the last few warm days brought an improvement, and they are now satisfactory. In some cases, where stock were turned out earlier than usual owing to shortage of other keep, the pastures have naturally made but little growth. Stock have generally thriven fairly well in spite of the inclement weather.

Lambing is now practically over, and the most recent reports are nearly all very satisfactory: in the north the fall has been at least average and often above, while reports of excessive mortality are few; and in the south the later flocks appear to have done better than the early ones.

While in many parts of the country labour is reported as sufficient, yet in many counties there is a scarcity, particularly of the more skilled men.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on May 1st, 1913, certain diseases of animals existed in the countries specified:—

Austria (for the period April 16th—23rd).
Anthrax, Blackleg, Foot-and-Mouth Disease (total of 70 Hofe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period March 16th—31st).
Anthrax, Blackleg, Foot-and-Mouth Disease (12 outbreaks in 12 communes), Rabies.

Bulgaria (no further returns received).

Denmark (month of March).
Anthrax, Foot-rot, Swine Erysipelas.

France (for the period April 6th—12th).
Anthrax, Blackleg, Foot-and-Mouth Disease (73 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period April 1st—15th).
Foot-and-Mouth Disease (17 infected places in 14 parishes), Glanders and Farcy, Swine Fever.

Holland (month of March).
Anthrax, Foot-and-Mouth Disease (11 outbreaks in 7 provinces), Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (for the period April 2nd—9th).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 19 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period April 7th—13th).
Anthrax, Foot-and-Mouth Disease (1,521 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (no further returns received).

Norway (month of March)
Anthrax, Blackleg.

Rumania (for the period March 29th—April 5th).
Anthrax, Dourine, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of December).
Anthrax, Foot-and-Mouth Disease (3,702 animals in 55 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (no further returns received).

Spain (month of February).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (368 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of March).
Anthrax, Blackleg.

Switzerland (for the period April 14th—20th).
Anthrax, Blackleg, Foot-and-Mouth Disease (85 "étables" entailing 738 animals, of which 22 "étables" were declared infected during the period), Swine Fever.

Agricultural Labour in England during April.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in April:—

The employment of labourers outside the regular farm staff was interrupted by rain to some extent in April in most districts—in certain cases seriously so. Apart from days on which the weather stopped work, there was a moderately good demand for extra men, which would have been greater in many districts but for the sodden condition of the soil; the demand chiefly arose from such work as threshing, hedging, fencing, ditching, draining, carting and spreading manure, preparing the land for potatoes, potato-planting and hoeing.

The supply of extra men was rarely reported as in excess of requirements, while mention of an insufficient supply was somewhat frequent in the reports. Districts in which a surplus was reported included the Scarborough (*Yorkshire*), Sharnbrook (*Bedfordshire*), Mildenhall (*Suffolk*), Epsom (*Surrey*), Droxford (*Hampshire*), Wantage (*Berkshire*), and Dorchester and Wareham (*Dorset*) rural districts.

Some scarcity of extra men was reported in parts of the following rural districts:—Cockermouth and Longtown (*Cumberland*), Leyburn (*Yorkshire*), Bucklow and Tarvin (*Cheshire*), Hinckley (*Leicestershire*), Tamworth (*Staffordshire*), Droitwich (*Worcestershire*), Meriden and Rugby (*Warwickshire*), Brixworth, Daventry, Hardingstone, Oundle, and Potterspury (*Northamptonshire*), Banbury and Witney (*Oxfordshire*), Newport Pagnell (*Buckinghamshire*), Berkhamsted (*Hertfordshire*), Chesterton and Ely (*Cambridgeshire*), Brigg, Gainsborough, and Spilsby (*Lincolnshire*), Downham, and East and West Flegg (*Norfolk*), Cosford (*Suffolk*), Rochford and Saffron Walden (*Essex*), Dover, East Ashford, Eastry, Isle of Thanet, and Maidstone (*Kent*), Dorking (*Surrey*), Cuckfield, Rye, and Westhampnett (*Sussex*), Romsey and Winchester (*Hampshire*), Wilton (*Wiltshire*), Blandford (*Dorset*), Frome, Taunton, and Wells (*Somerset*), Dursley (*Gloucestershire*), Newton Abbott (*Devonshire*), and Camelford, Liskeard, and West Penwith (*Cornwall*).

Men for permanent situations were reported as in demand in several counties; and especially so in *Northamptonshire*, *Kent*, *Sussex*, *Somerset*, *Gloucestershire*, and *Cornwall*.

THE CORN MARKETS IN APRIL.

C. KAINS-JACKSON.

Wheat.—There have been few changes in the price of English wheat, the markets getting the best samples showing averages a little above or under 33*s*., while those at which damp and damaged corn predominated have had to accept about 28*s*. The effective comparison of country markets with Mark Lane is never easy, but with respect to tailings and inferior wheat, it seems clear that London prices have paid the transmitter of such kinds whenever the railway charges were under eighteenpence per quarter. Poultry wheat in London has fetched 28*s*. per 448 lb., and has gone promptly into use for chicken feeding. In the country the official averages show that

28s. has commanded in many cases 480 lb. of wheat. The large and sustained demand for feed wheat has of recent months been a feature of Mark Lane; not only does English go at once into use, but Canadian feed is in constant request, the price ruling being 28s. per 480 lb. The demand for fine hard dry wheat from abroad has been good all through April, and, supplies to hand from Canada and the United States proving inadequate of those kinds, a smart advance in their selling value has taken place. On the 30th quotations included 38s. 6d. for American Red Winter, 41s. for best Canadian, and 40s. for No. 2. The New Zealand crop being reported to be barely sufficient for home use, the small supplies of 1912 produce in British granaries at once improved in selling value. Some fine "longberry" is still obtainable at 42s. per qr., but "shortberry" is hardly met with. Australian wheat is dear by comparison with sorts nearest to it in quality. It is true that half a million quarters less of it are on passage as compared with a year ago; still, 1,250,000 qr. are on the high seas, and this is no mean expectation. The price averaged in April has been 41s. to 42s., but with freer arrivals of cargoes on passage the new crop will, it is apprehended, be obtainable before May is out at lower rates. Indian is also inclined to favour buyers, who can wait a fortnight before needing delivery. As to Argentine, of which a million and a half quarters are on passage, the spot price at the end of April was 2s per qr. above the cargo quotations for May arrival. Russian wheat has remained steady at 36s to 37s. for Odessa Ghirka type, and 37s. 6d. to 38s. for stronger sorts. The two sustaining influences of April in the general trade have been a good Continental demand and the failure of affairs in the Near East to settle down. The acceptance of lower prices for June delivery has, however, defined the margin of time during which 40s. wheat might be expected to predominate. There are altogether four million quarters on passage, and the great exporting countries show no signs of relaxing their energies. During April North America shipped 1,288,000 qr., South America 3,342,000 qr., India 167,000 qr., Australia 647,000 qr., Russia 571,000 qr., and Europe S E. 315,000 qr. The increased efforts of the New World have been a leading feature in the shipping trade. New York prices on the ordinary market are 35s. to 35s. 6d. for Red Winter, and 35s. 6d. to 36s. for No. 1 Spring. It is unusual for the two sorts thus to approximate in price, the No. 1 Spring often being a florin dearer than the winter corn. Freights to London are 2s. per qr., and all other charges being averaged at 1s., we get the selling price of American in London at a presumptive 38s. to 39s. per 480 lb. New York therefore cannot be said to be a weakening influence. Since September 1st the supplies of British wheat have been much below the average, and those of imported wheat much above it. Stocks in the fifteen chief ports show no substantial change on the year, and a good average consumptive demand appears to be indicated. There is apparently no falling off to be attributed to the mild winter, though complaints of small purchases of bread were heard among bakers, and were alleged as a reason for giving but small orders for flour.

Flour.—Imports of flour since the commencement of the cereal year have been rather over three million sacks, but this is at the rate of less than five million sacks per annum, and the receipts from abroad

have not been depressing any port market. The home milling trade complains of increased charges for distribution and manufacture.

Prices for Household flour rose 1*s*. 6*d*. in London during April, but the advance was rather theoretical than practical, orders given in March at old terms being, of course, fulfilled, while new orders during the time of nominal dearness were but seldom given. Country and imported flour is about 6*d*. dearer on the month. North America shipped only 461,000 sacks, a decided decline from the figures of February and March. There were on the 30th 216,000 sacks on passage, of which 186,000 sacks (a liberal total) were coming from Atlantic ports, and 30,000 sacks (a very small quantity) from all other sources of origin.

Barley.—Good malting samples have been shown at Reading and Newbury, Shrewsbury and Worcester, Colchester and Ipswich. The three regions where quality has held out best are tolerably well defined, namely, the Upper Thames Valley, the corn lands by the Severn, and the region between the Thames and the Waveney. Norfolk, to the north of the last-named district, has been returning some wretched averages. Mark Lane prices for home-grown barley have been quite poor. Imported barley has fallen 1*s*. for malting and 6*d*. for grinding descriptions. Of neither have the sales been good. Newly-arrived American, Argentine, and Russian have all shown very inferior quality. There were only 285,000 qr. on passage to the United Kingdom at the end of the month, and the imports since Easter have been below the average. The shipping countries in April sent off the following quantities:—California, 105,000 qr.; Atlantic ports, 90,000 qr.; Russia, 700,000 qr.; Roumania, 168,000 qr.; Argentina, 20,000 qr.; and India, 15,000 qr.

Oats.—No important changes are to be discerned in the English average prices for oats. Argentine oats have appreciated on the month, the recovery being fully 1*s*. per qr Apparently 16*s*. per qr. is now a price at which the demand for actual use immediately expands. On the 30th other sorts of oats than English or Argentine were scarce on spot. Prices making were:—New Zealand, 22*s*. per 320 lb.; North Russian, 23*s*. per 320 lb.; Black Libau, 20*s*. per 304 lb ; American White Clipped, 20*s*. per 320 lb.; and fine Canadian White, 22*s*. per 320 lb. There were 310,000 qr. on passage. The great shipping countries exported oats as follows:—Russia, 140,000 qr.; Argentina, 843,000 qr.; North America, 83,000 qr.; and Australasia, 10,000 qr. The Russian shipments were so singularly small as to be a materially strengthening influence on the whole trade.

Maize.—About 26*s*. per qr. has been the spot price for ordinary descriptions. The month's shipments were 1,023,000 qr. from the United States, 531,000 qr. from Argentina, 140,000 qr. from Russia, 127,000 qr. from Europe S.E., and 30,000 qr from Burma. On the 30th 400,000 qr. were on passage, and, as this is less than usual, values are expected to be supported, it may even be with stiffness, until the new Argentine crop is well under weigh. This will hardly be before Midsummer Day is past.

Oilseeds.—Small quantities of English, Dutch, Russian, and Morocco linseed are on offer, and the mean price for all fine "quality" types is about 54*s*. per 416 lb. Argentine at 45*s*. per 416 lb., and

Indian at 46*s*. 6*d*. to 48*s*., are in fair request. The quantity on passage has fallen to 115,000 qr., but the Indian new crop will reach the ports soon, and the immediate future of this trade depends on the strength with which it is held or the energy with which it is shipped. Linseed shipments for April were 554,000 qr. from Argentina and 89,000 qr. from India. Cottonseed remains dear. A low Nile is reported, but is not expected to put the cottonseed crop in jeopardy as in the old days before the water supply was regulated. The dearness of cottonseed is due to the demand of recent years having steadily gained upon the production.

Various.—There have been no material changes in beans, peas, beet-sugar, or rice, but muttor, and Indian small pulse generally, have fallen about 1*s*. per qr. The by-products of the mill have been cheap, and this has been beneficial to those with animals and poultry to feed.

THE LIVE AND DEAD MEAT TRADE IN APRIL.

A. T. MATTHEWS

Fat Cattle.—Supplies of cattle in English markets have not increased, and the actual numbers exposed still show a considerable falling-off when compared with the average of the last three years The general condition has, however, been very good, especially considering the poor quality of the hay grown last year. The trade has been exceedingly firm, and prices, especially those for Shorthorns, have shown a tendency to harden. The other breeds, which are more limited in numbers and distribution, have their seasons in several of the larger markets, and therefore the Shorthorns form the more reliable guide to general market movements.

The following are the average prices of the various breeds in over twenty English markets during April:—Shorthorns, 9*s*. 3*d*. and 8*s*. 6*d*. for first and second quality, against 9*s*. 2*d*. and 8*s*. 5*d*. in March; Herefords, 9*s*. 8*d*. and 9*s*. 1*d*., against 9*s*. 4*d*. and 8*s*. 9*d*.; Devons, 9*s*. 3*d*. and 8*s*. 4*d*., against 9*s*. 4*d*. and 8*s*. 5*d*.; Welsh Runts, 9*s*. 2*d*. and 8*s*. 6*d*., against 9*s*. 1*d*. and 8*s*. 7*d*.; and Polled Scots, 9*s*. 5*d*. and 9*s*. 1*d*., against 9*s*. 5*d* and 8*s*. 10*d*. pere 14 lb. stone. The Welsh cattle were quoted in very few markets, they being essentially a grazing breed, and chiefly marketed in the summer and autumn months. Devons have been well represented in the London market, coming, not only from their native district, but in considerable numbers from Norfolk, where they were purchased in the autumn at high prices, instead of the Irish Shorthorns which form the usual supply. Some of the latter, however, have lately been present, and so popular are they with Islington buyers that they have fetched fully as much per stone as the well-fed Devons. The Devons coming from the west country have chiefly been young and small in size.

Veal Calves.—There was the usual increase in the supply of fat calves, characteristic of the time of year, and though the demand was very good, prices have been lower than in March, the averages being about 9¾*d*. and 8¾*d*. per lb. for first and second quality, against 10½*d*. and 9¼*d*. in the previous month.

Fat Sheep.—In the fifteen weeks ending April 16th the total supplies of fat sheep in English markets were over 100,000 short of the average of the three preceding years, representing a shortage of about 12½ per cent. The sheep are, however, in much riper condition than last year, which is a partial compensation. The coming of the lamb season has to some extent weakened the position as regards mutton, and March prices have scarcely been maintained. Reliable comparisons are difficult just now, as a large proportion of the best sheep are clipped. The general average prices of those in wool are as follows:—Downs, 10*d.*, 9*d.*, and 7½*d.* for the three qualities, against 10½*d.*, 9½*d.*, and 7½*d.* in March; Longwools, 10*d.*, 9*d.*, and 7½*d.* against 10½*d.*, 9*d.*, and 7½*d.* per lb. In the week ending April 9th there was a difference between the average price of clipped Downs and those in the wool of 1¾*d.* per lb., and 2*d.* in the case of Longwools. As the month advanced there was a relatively better demand for clipped sheep, but this is by no means unusual.

Fat Lambs.—In view of the equally high price of mutton, it is curious to note that fat lambs have been fetching lower average prices than at the same period last year. They have been rather irregular in value at different markets, but have averaged about 1*s.* 0½*d.* and 11½*d.* per lb. in English markets.

Fat Pigs.—The shortage in the supply of fat pigs has amounted to over 36,000 in the last fifteen weeks, compared with the three years' average, and values are about 1*s.* 7*d* per 14 lb. stone higher than a year ago. They have continued to sell well during April, 8*s.* 6*d.* per stone for prime quality bacon pigs being about the general average.

Carcass Beef—British.—All descriptions of home-killed beef have been quietly steady, with scarcely any change from March prices. The averages in the London Central Market were:—Scotch short sides, 4*s.* 9*d.* and 4*s.* 7*d.* per 8 lb. for first and second quality; long sides, 4*s* 8*d.* and 4*s* 6*d.*; English, 4*s.* 6*d.* and 4*s.* 4*d.*; and Irish, 4*s.* 5*d.* and 4*s.* 3*d.*

Canadian Beef—After an absence of many months a few Canadian sides have been on offer, and have fetched 4*s.* 4*d.* and 4*s.* 3*d.* per 8 lb.

Chilled Beef.—The price of Argentine chilled began low at 3*s.* 2*d.* per 8 lb. for best kinds, and 2*s.* 3*d.* for fores, but in the second week it was forced up by the news of the great fire at La Blanca, and as much as 6*d.* per lb. was occasionally realised. Afterwards there was a partial relapse, and the averages for the month were 3*s.* 7*d.* and 3*s.* 2*d.* for hindquarters, and 2*s.* 7*d.* and 2*s.* 5*d.* for forequarters.

Frozen Beef.—From the same cause as that affecting chilled, frozen beef became dearer after the first week, and prices exceeded those of March by about ½*d.* per lb. for hindquarters, which averaged 2*s.* 9*d.* and 2*s.* 6*d.* Forequarters averaged 2*s.* 4*d.* and 2*s.* 2*d.* per stone.

Carcass Mutton—Fresh-Killed.—The trade was very even till about the 23rd, very small Scotch carcasses making 5*s.* 8*d.*, and seven-stone sheep 5*s.* 2*d.* per stone. The weather becoming warmer at that date prices gave way to some extent, and the averages for the month were about 5*s.* 7*d.* and 5*s.* 1*d.* for Scotch, and 4*s.* 11*d.* and 4*s.* 8*d.* for English. These prices do not include English ewes, which often made about 6*d.* per lb.

Frozen Mutton.—This article has been slightly dearer than in March. New Zealand averaged 3*s*. 1*d*. and 2*s*. 8*d*.; Argentine, 2*s*. 9*d*. and 2*s*. 6*d*.; and Australian, 2*s*. 9*d*. and 2*s*. 5*d*. per 8 lb.

Lamb—Fresh-Killed.—English lamb has remained at a very moderate price, and considerably less than at this time last year. There was a fall of 1*d*. per lb. during the month, the best declining from 8*s*. to 7*s*. 4*d*. per 8 lb. The average prices for the whole month were 7*s*. 4*d*. and 6*s*. 8*d*. for first and second quality.

Frozen Lamb.—New Zealand lamb has been in fair request, and rather dear at an average of 4*s*. 6*d*. and 4*s*. per stone for first and second quality. Australian has made 4*s*. and 3*s*. 9*d*. The Argentine lamb on offer has been of large size, and would be better described as mutton.

Veal.—Both English and Continental veal have been plentiful, and much cheaper than in the preceding month. The averages for the former were 5*s*. 3*d*. and 4*s*. 3*d*. per stone, and for the latter 5*s*. 4*d*. and 4*s*. 4*d*. A good deal of veal has come from Sweden, as well as from Holland.

Pork.—After a long period of steady trade at full prices there was an advance in the second week, and best small English pigs were making 5*s*. 6*d*. per stone. This trade is very sensitive to changes of weather, and a rather heavy fall took place about the 22nd. English averaged 5*s*. 3*d*. and 4*s*. 10*d*., and Dutch 5*s*. 1*d*. and 4*s*. 8*d*. per stone for first and second quality.

THE PROVISION TRADE IN APRIL.

HEDLEY STEVENS.

Bacon.—The demand for long sides has shown an improvement during the month, with prices hardening towards the end of the month. On account of the abnormally high prices for the raw material, trading continues unsatisfactory from a profit standpoint, both for the curers and dealers, except in the case of Danish bacon, pigs being reported to be proportionately cheaper in Denmark.

The American markets, although slightly easier, are still very high, and general reports point to even higher prices during the summer months, as stocks on hand are small, and with continued scarcity of beef, the consumptive demand remains above the average for hog products. The quantity of hogs being marketed in the States, although slightly larger, continues below the average. Prices at Chicago for the month have ranged from $8 10 to $9 40, against $7.30 to $8.10 last year, and $5.65 to $6.70 two years ago. The United States Government's yearly statistics, recently issued, give deaths of hogs on the farms as 6,736,000, or about 11 per cent., which is considerably more than statistics showed at the corresponding time of last year.

Receipts of cured bacon from Canada continue to decrease, as the Canadian curers report that pigs, on account of scarcity, are making prohibitive prices. Some of the curers have discontinued killing for the English markets.

English and Irish pigs are eagerly sought after by the curers, and

they find it difficult to make a profit for the cured product, when competing with Danish bacon.

Cheese.—The month's trading has been of a disappointing nature, both as regards volume of business and prices realised. At the end of the month, quotations for both Canadian and New Zealand makes were from 2*s.* to 3*s.* per hundredweight cheaper, and English also somewhat easier. Dealers having unsold high-priced New Zealands on spot and to come forward (contracted in some cases at 68*s.* c.i.f.), have made an effort to lift prices above the prevailing selling prices, which have been around 60*s.* to 61*s.*, and to force business on "Coloured," which is more plentiful and cheaper than "White." Stocks of New Zealand cheese in London and Bristol at the end of the month were 55,600 crates (two cheese in each), against 21,000 crates at the end of April, 1912. Stocks of Canadian cheese at the end of the month at the three principal distributing centres (London, Bristol, and Liverpool) were 82,000 against 39,000 at the same time last year, and 89,000 two years ago. The decrease in the quantity of Canadian cheese exported to the United Kingdom during season just closed amounts to just under 5,000 tons, but it is expected this shortage will be nearly made up by the increase in arrivals from New Zealand. The Canadian season is reported to be late in opening, and up to April 18th the receipts of the new April make totalled only 695 boxes, as against 2,708 boxes up to the same date of last year. Prices for the new fodder makes were then around 56*s.* to 58*s.* c.i.f., but by the end of the month had dropped to 53*s.* to 54*s.* c.i.f.

Stocks of last season's English cheese are being reduced, but at less money. Dealers report a large proportion of inferior quality, which is difficult to sell, even at the reduced prices.

Butter.—Except for best selections of Colonial, the demand has again been small, and prices have generally favoured buyers, especially for the lower grades, which are difficult to sell, and stocks have accumulated. The quality of the new season's Siberian is reported to be very fine, and the arrivals easily cleared at satisfactory prices. In America prices remain very high, top figures for best selections being equivalent to 167*s.* c.i.f. In Canada prices are also very high, and in a recent issue of the *Montreal Trade Bulletin*, the editor writes — "Our production of butter during the season now drawing to a close has failed to meet the home requirements by about 125,000 to 130,000 packages, this quantity having been imported from New Zealand *viâ* West St. John, Portland, Maine, and Vancouver. It is the opinion of some in the trade that when the new tariff on the other side of the border comes in force, with milk and cream admitted free, our production will still further decrease, as the tendency will be to increase the make of cheese and butter in the United States with our milk and cream."

The new make in Ireland is smaller than expected, but quality is good, and satisfactory prices have been realised.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in April and March, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	April. First Quality.	April. Second Quality.	March. First Quality.	March. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots . ..	9 5	9 1	9 5	8 10
Herefords	9 8	9 1	9 4	8 9
Shorthorns . . .	9 3	8 6	9 2	8 5
Devons	9 3	8 4	9 4	8 5
Welsh Runts	9 2	8 6	9 1	8 7
	per lb *	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves ..	9¾	8¼	10½	9¼
Sheep:—				
Downs	9½	8¾	10¼	9½
Longwools	8¾	8¼	10¼	9
Cheviots	11	10	11½	10½
Blackfaced	10¾	10	11¼	10¼
Welsh	10½	9¼	10¼	9½
Cross-breds	9½	8¾	10¼	9½
	per stone.*	per stone.*	per stone *	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs .	8 6	8 0	8 7	8 0
Porkers . .	8 10	8 4	9 0	8 5
LEAN STOCK:—	per head	per head.	per head	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk	22 18	18 19	23 5	19 4
,, —Calvers . .	21 18	18 12	22 17	18 18
Other Breeds—In Milk ..	19 11	16 18	21 16	18 3
,, —Calvers . .	16 0	14 15	—	12 10
Calves for Rearing	2 9	1 17	2 8	1 17
Store Cattle:—				
Shorthorns—Yearlings	11 9	9 14	11 2	9 9
,, —Two-year-olds	15 15	13 17	15 9	13 8
,, —Three-year-olds	19 3	16 19	18 15	16 14
Herefords —Two-year-olds	18 2	15 8	17 13	14 15
Devons— ,,	16 6	14 10	16 0	14 14
Welsh Runts— ,,	15 12	13 17	16 12	14 13
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	51 5	45 9	50 4	44 3
Store Pigs:—				
8 to 10 weeks old	25 8	20 10	24 0	19 4
12 to 16 weeks old	36 3	29 3	36 9	29 4

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in April, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham. s.	d.	Leeds. s.	d.	Liverpool. s.	d.	London. s.	d.	Manchester. s.	d.
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
BEEF :—											
English	1st	62	6	62	6	61	0	63	6	62	0
	2nd	58	0	60	0	58	6	61	6	59	6
Cow and Bull	1st	55	0	57	6	52	6	50	6	55	0
	2nd	50	6	52	6	45	0	45	6	50	6
Irish : Port killed	1st	—		61	0	61	0	61	6	—	
	2nd	—		57	0	57	6	59	6	—	
Argentine Frozen—											
Hind Quarters	1st	38	0	37	0	38	6	36	6	38	6
Fore ,, ...	1st	32	0	31	6	31	6	31	0	31	6
Argentine Chilled—											
Hind Quarters	1st	50	0	48	6	48	0	49	6	48	6
Fore ,, ...	1st	35	6	35	6	36	0	35	6	36	0
Australian Frozen—											
Hind Quarters	1st	36	0	36	0	34	6	36	0	34	6
Fore ,, ...	1st	32	6	31	6	31	6	30	0	31	6
VEAL :—											
British	1st	—		75	6	85	6	73	0	80	6
	2nd	79	6	69	0	76	0	59	6	74	0
Foreign ...	1st	—		—		—		74	6	—	
MUTTON :—											
Scotch	1st	—		—		86	0	77	6	87	6
	2nd	—		—		80	6	71	6	83	0
English	1st	74	0	75	6	79	0	69	0	81	0
	2nd	69	0	73	6	74	0	65	0	76	6
Irish : Port killed	1st	—		—		79	0	—		—	
	2nd	—		—		74	0	—		—	
Argentine Frozen	1st	39	6	39	6	39	0	39	0	39	0
Australian ,, ...	1st	38	0	38	0	37	0	38	0	37	0
New Zealand ,, ...	1st	42	0	—		—		42	6	—	
LAMB :—											
British	1st	104	6	114	0	108	6	101	6	108	6
	2nd	97	0	102	6	98	0	92	6	99	0
New Zealand	1st	65	0	64	0	62	6	63	0	63	0
Australian	1st	56	6	56	6	55	6	56	0	55	6
Argentine	1st	57	0	56	6	55	6	—		55	6
PORK :—											
British	1st	74	6	73	6	74	6	73	6	74	6
	2nd	70	0	71	0	68	0	67	6	68	6
Foreign	1st	—		—		—		70	6	—	

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913.

Weeks ended (in 1913).	WHEAT.						BARLEY.						OATS.					
	1911.		1912.		1913.		1911.		1912.		1913.		1911.		1912.		1913.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan. 4	30	5	33	2	30	5	23	11	33	3	28	6	17	0	20	7	19	10
,, 11	30	8	33	1	30	3	23	10	33	0	28	4	17	2	20	8	19	2
,, 18	30	11	33	4	30	5	24	4	33	3	28	6	17	4	20	11	19	4
,, 25	30	11	33	7	30	11	24	5	33	1	28	10	17	3	21	1	19	4
Feb. 1	30	9	33	8	31	1	24	5	32	10	28	11	17	5	21	3	20	2
,, 8	30	5	34	0	31	0	24	6	33	2	28	10	17	5	21	4	20	1
,, 15	30	3	34	4	30	9	24	7	32	10	29	1	17	6	21	7	20	2
,, 22	30	2	34	6	30	11	24	9	32	8	28	8	17	7	21	9	20	7
Mar. 1	30	0	34	1	31	0	25	0	32	0	28	6	17	5	21	6	20	4
,, 8	30	1	34	1	31	3	25	0	31	7	28	5	17	5	21	8	20	0
,, 15	30	1	34	0	31	1	24	11	31	2	27	11	17	6	21	8	20	2
,, 22	30	2	34	1	31	1	25	0	31	10	28	6	17	5	21	9	19	11
,, 29	30	3	34	4	31	3	24	11	30	3	27	6	17	5	21	8	19	7
Apl. 5	30	4	34	10	31	4	24	7	30	9	27	0	17	7	21	11	19	2
,, 12	30	3	35	4	31	3	25	2	30	2	27	8	18	3	22	1	19	2
,, 19	30	4	36	7	31	6	25	5	29	11	26	11	17	10	22	4	18	10
,, 26	30	11	37	10	31	8	25	5	30	4	26	7	18	3	22	9	19	3
May 3	31	4	38	1	32	2	25	7	30	2	25	11	18	6	23	1	19	6
,, 10	31	8	37	11			25	1	31	1			19	0	23	7		
,, 17	32	6	37	8			25	4	31	2			19	2	23	7		
,, 24	32	8	37	2			25	0	31	1			19	5	23	7		
,, 31	32	5	36	10			24	10	30	0			19	5	23	9		
June 7	32	4	36	11			25	7	29	11			19	7	24	0		
,, 14	32	3	37	0			23	11	30	8			19	8	23	10		
,, 21	31	11	37	5			23	9	30	8			19	10	24	0		
,, 28	31	10	37	10			24	5	30	2			19	9	23	11		
July 5	32	1	38	2			25	10	31	7			19	9	23	11		
,, 12	32	3	38	3			25	10	30	2			19	11	24	1		
,, 19	32	5	38	10			24	3	30	9			19	5	24	8		
,, 26	32	5	38	9			23	8	30	9			19	7	23	4		
Aug. 2	32	0	38	4			24	4	28	6			18	2	22	2		
,, 9	31	6	39	2			26	9	30	7			18	0	22	4		
,, 16	31	6	38	2			27	8	28	3			17	10	21	8		
,, 23	31	8	35	6			28	10	28	1			18	0	20	10		
,, 30	31	7	34	10			28	4	28	6			18	3	20	8		
Sept. 6	31	10	35	1			28	4	29	9			18	1	21	8		
,, 13	32	0	33	5			29	0	29	0			18	5	20	5		
,, 20	32	4	32	7			29	11	29	6			18	9	19	10		
,, 27	32	6	31	7			30	5	29	9			19	1	19	5		
Oct. 4	32	7	31	8			30	9	29	7			19	5	19	8		
,, 11	32	9	31	10			31	0	30	4			19	10	19	5		
,, 18	32	9	32	2			31	5	30	11			19	11	19	9		
,, 25	33	1	33	1			31	7	31	6			20	6	19	10		
Nov. 1	33	4	33	4			31	10	31	10			20	8	20	1		
,, 8	33	4	33	1			32	7	31	11			20	11	19	11		
,, 15	33	1	32	10			32	10	31	2			21	0	19	9		
,, 22	33	0	32	1			33	5	30	11			20	10	19	11		
,, 29	32	10	31	9			33	10	30	8			20	11	19	8		
Dec. 6	32	9	31	0			34	0	29	11			20	9	19	6		
,, 13	32	11	30	8			33	5	29	2			20	9	19	3		
,, 20	32	9	30	7			33	5	28	11			20	8	19	4		
,, 27	33	0	29	10			33	4	28	6			20	7	19	2		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.		BARLEY.		OATS.	
		1912.	1913.	1912.	1913.	1912.	1913.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France:	March	46 7	47 7	29 8	30 1	23 5	23 10
	April	49 7	48 9	30 2	30 1	24 0	24 0
Paris:	March	48 6	48 11	29 0	30 6	24 6	22 10
	April	52 2	50 10	29 5	30 6	25 8	23 9
Belgium:	February	35 2	34 5	30 3	30 5	24 6	23 2
	March	35 3	34 5	30 7	30 2	24 11	22 9
Berlin:	February	45 6	42 10	—	—	27 9	23 5
	March	45 5	43 1	—	—	27 8	22 8
Breslau:	February	40 4	37 8	32 10* 28 6†	29 2* 26 5†	25 11	21 7
	March	40 4	37 4	32 10* 28 11†	27 1* 25 8†	25 7	20 9

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of April, 1912 and 1913.

—	WHEAT.		BARLEY.		OATS.	
	1912.	1913.	1912.	1913.	1912.	1913.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London...	37 0	33 3	32 11	24 2	23 8	18 11
Norwich	35 7	32 9	30 3	26 2	22 1	19 10
Peterborough	36 4	29 10	29 7	25 3	22 8	17 1
Lincoln...	36 3	29 0	28 11	28 3	22 4	19 6
Doncaster	34 4	28 11	28 7	26 9	21 8	18 7
Salisbury	36 2	31 4	31 2	26 11	22 4	19 6

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in April, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	15 6	14 6	—	—	14 0	13 0
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	117 0	114 6	114 0	112 0	116 0	114 0
,, Factory . ..	102 0	90 0	102 0	93 0	—	—
Danish	—	—	123 0	121 0	123 6	121 6
French	—	—	—	—	132 6	125 0
Russian	112 0	109 6	111 6	109 0	109 6	107 6
Australian	114 6	109 0	111 6	107 6	115 0	110 6
New Zealand	119 0	117 0	117 0	115 0	118 6	116 0
Argentine	112 6	109 0	109 0	106 6	111 6	108 0
CHEESE :—						
British—						
Cheddar ..	75 0	65 0	75 0	72 0	78 6	73 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	77 0	71 6	77 0	70 0
			per cwt	per cwt	per cwt.	per cwt.
Canadian ...	64 6	62 0	64 0	61 0	65 0	64 0
BACON :—						
Irish ..	78 0	75 0	78 0	74 6	79 0	76 6
Canadian ..	74 0	72 0	72 6	69 6	74 0	72 0
HAMS :—						
Cumberland	—	—	—	—	116 0	108 0
Irish .	—	—	—	—	111 0	107 0
American						
(long cut) ..	78 0	76 0	77 6	74 6	80 6	77 0
EGGS :—	per 120.	per 120	per 120.	per 120.	per 120.	per 120.
British .. .	8 4	6 8	—	—	9 2	8 4
Irish ..	8 9	8 5	8 9	8 1	9 5	8 3
Danish .	—	—	—	—	9 7	8 3
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	110 0	85 0	86 6	80 0	105 0	90 0
Langworthy . ..	120 0	115 0	98 6	95 0	129 0	119 0
Up-to-Date	101 6	88 6	86 6	83 6	99 0	88 0
HAY :—						
Clover	105 0	90 0	103 0	90 0	128 0	111 0
Meadow	90 0	72 6	—	—	115 6	99 0

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	APRIL.		FOUR MONTHS ENDED APRIL.	
	1913	1912.	1913.	1912.
Anthrax:—				
Outbreaks	60	68	234	394
Animals attacked ...	60	87	251	444
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	14	11	60	57
Animals attacked .	58	29	198	132
Parasitic Mange:—				
Outbreaks	227	245	1,236	1,771
Animals attacked	431	411	2,565	3,972
Sheep-Scab:—				
Outbreaks . ..	7	6	112	150
Swine-Fever:—				
Outbreaks	223	316	690	1,106
Swine Slaughtered as diseased or exposed to infection ...	3,511	4,217	9,330	14,025

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	APRIL		FOUR MONTHS ENDED APRIL.	
	1913.	1912.	1913.	1912.
Anthrax:—				
Outbreaks	—	—	—	1
Animals attacked ..	—	—	—	1
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	5	4	79	31
Sheep-Scab:—				
Outbreaks	35	32	245	240
Swine-Fever:—				
Outbreaks	10	35	48	87
Swine Slaughtered as diseased or exposed to infection ...	88	299	288	712

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FECUNDITY IN FOWLS.

A REMARKABLE paper, dealing with the inheritance of fecundity (laying capacity) in the domestic fowl, has recently been published by Dr. Raymond Pearl, of the Maine Experiment Station.*

The contribution in question has been briefly noticed in scientific and practical journals, but since the conclusions reached by Mr. Pearl have an important economic bearing, they merit a fuller exposition than has hitherto been accorded to them.

In the following pages an attempt will be made to divest the subject of the technicalities that its connection with Mendelian theory inevitably entails, and to present the results in a form more applicable to practical conditions. At the same time, it should be stated that the investigation is of supreme scientific interest, inasmuch as it is one of the few instances in which (if Mr. Pearl's results are confirmed for all breeds of fowls) the inheritance of animal characters of direct economic value has been proved to be governed by Mendelian laws.

The work under notice is the outcome of a series of investigations into the inheritance of fecundity which have occupied five years, and have been concerned with the egg-laying records of several thousands of individuals.†

The work began on the lines familiar to all practical breeders of animals. It was assumed that by progressive selection of the best laying hens of one breed (in this case

* "The Mode of Inheritance of Fecundity in the Domestic Fowl," *Journal of Experimental Zoology*, Vol. xiii., No. 2.

† *Journal*, Nov. 1911, p. 659.

Barred Plymouth Rocks) and their progeny, a gradual improvement in fecundity would take place, and that, eventually, a strain would be established which would breed true to high egg-production.

In a previous paper * Mr. Pearl has shown that this method was entirely barren of result, and that progressive selection in the mass, based solely on the laying record of the hens employed, was unable *by itself* † to secure the desired object, that is to say, the establishment of a new strain with a high average egg production. Mr. Pearl's discovery, stated as briefly as possible, is that the *male* is the principal agent in transmitting fecundity, *and that selection of cocks must be practised, as well as selection of hens,* in building up the desired strain of high fecundity fowls.

It is necessary, at the outset, to have a clear idea as to what is meant by fecundity, and how it shall be measured. Mr. Pearl's conclusion is that the distinguishing differences in egg-production between good and bad laying hens occur in the winter period, October 1st to March 1st. In other words, he found (for the breeds with which he worked) that, on the average, there is little difference between one fowl and another in the number of eggs laid in the spring and summer, whereas the differences between strains (and individuals) in the number of eggs laid during the winter are very marked. Thus, the strain of Indian Game with which he worked gave an average winter egg production of less than one-third of that given by a strain of Plymouth Rocks. For the purposes of his investigation, therefore, Mr. Pearl adopted the winter egg-production as the measure of fecundity, and it should be understood that in all subsequent references to fecundity the production for the winter period only is meant.

It was found that hens can be placed in three distinct classes: (*a*) those laying no eggs whatever during the winter period; (*b*) those laying under 30 eggs; and (*c*) those laying over 30 eggs. Avoiding all Mendelian phraseology, certain results obtained by Mr. Pearl may now be stated as facts, entirely independent of any theory which may be framed to account for them.

* *Journal*, Nov. 1911, p. 659.

† That is to say, without selection of the cocks—such as *might* result from using the male offspring of the selected hens.

He found, then, that if he took hens of his third class (those laying 30 eggs and upwards during the winter period) and bred them to certain cocks, none of the daughters showed a laying capacity of over 30 eggs. In other words, hens of high productiveness were unable (when mated with certain cocks) to transmit their qualities to their daughters. On the other hand, he found that hens of the 30 and over class, if mated with certain other cocks, gave sometimes *all* highly productive daughters, and, sometimes, partly high producers and partly low producers. Again, he found that if he mated certain cocks with hens of zero, or low producing capacity, he got *all* the daughters producing 30 eggs and over. As concrete illustrations of these statements the following figures may be given :—

(A) To show that a highly productive hen does not transmit her fecundity to her daughters :

One Indian Game Cock × Six Plymouth Rock Hens, all laying thirty eggs and over.

Seventeen hens averaging fourteen eggs. | Three hens laying no eggs.

(B) To show that a hen of low fecundity may produce daughters of high fecundity :—

Three Plymouth Rock Cocks * × Six Plymouth Rock Hens laying under thirty eggs

Nine hens averaging fifty-five eggs. | Seven hens averaging nineteen eggs.

(C) To show that hens of high fecundity produce nearly all fecund daughters when properly mated :—

Nine Plymouth Rock Cocks × Thirty-eight Plymouth Rock Hens laying thirty eggs and over.

111 hens averaging 56 eggs | Six hens averaging 20 eggs

(D) To show that certain selected cocks will produce practically all fecund daughters, *however mated* :—

One Plymouth Rock Cock × Ten Plymouth Rock Hens of all classes from zero upwards.

Sixteen hens averaging fifty-one eggs. | One hen averaging thirty eggs.

It should be noted that the same facts were observed when either Plymouth Rocks or Indian Game were mated *inter se*,

* From other tests it was known that these cocks were getting high-laying hens.

and also in the first crosses of the two breeds, as well as in the descendants of the hybrids.

At first sight these figures might suggest that fecundity is not inherited, but that such cannot be the case is apparent from the following facts:—

(*a*) The different standard breeds of fowls differ markedly in fecundity, and transmit their characteristics in a fairly constant degree.

(*b*) Pedigree records show that, within many breeds, there are lines, or strains, which breed true to high fecundity.

(*c*) The diversity of the above figures can be explained on a consistent theory of inheritance, based on the Mendelian conception of "unit characters" and "segregation."

The point, however, must again be emphasised that the statements hitherto made (on Mr. Pearl's authority) are independent of any such theory, and can be attacked on two grounds only, either (1) that the observations were inexact, or (2) that the observed facts are applicable only to the breeds and strains experimented with.

The Mendelian theory alluded to, if established, makes it possible to predict the numbers of birds which should fall into the various categories. The following figures show how close the fit is between theory and observation:—

Table showing the observed and expected distributions of winter egg production of *all* progeny of *all* matings.

Classes	Birds laying over thirty eggs	Birds laying under thirty eggs.	Zero
Observed.	460	459	77
Expected.	476	464	56

The only significant discrepancy is in the case of the zero birds. In regard to them it is explained that many of the birds that did not lay suffered from some physiological or mechanical defect, which was probably individual and not inherited.

It is due to Mr. Pearl to add that he does not claim that his results are necessarily true for all breeds or strains of poultry, and that he recognises the possibility that different schemes of inheritance may apply to other breeds. In fact, he

suspects that the two breeds with which he experimented—the Plymouth Rocks and the Indian Game—may differ in regard to the working of one of the "unit characters" which he has postulated.

The question that naturally suggests itself is: If the facts and theory outlined above are correct, will they assist the practical man in an endeavour to improve the fecundity of his stock? This question Mr. Pearl promises to answer in a future paper, but without undue intrusion into the domain of another, it is possible to indicate, briefly, how one would proceed under the guidance of the theory.

Clearly, the main desideratum is to produce the cock which invariably gets daughters of high fecundity; to do so, the high fecundity hen must be found by selection; she will transmit her desirable character through her sons, but only in certain cases will all these sons be of the highest quality. If all are of the highest quality (that is, invariably getting high fecundity daughters, however mated), then their *father* is the male wanted. But if, as is more likely, the sons differ, each must be tested by mating, with a view to ascertaining what his quality is. This testing should be done, preferably, *with zero hens*, for if the male is not of the highest class he will, when mated with such hens, get daughters of low fecundity. Such, in outline, would be the method of procedure: it would be necessary to push in-breeding as far as practicable, and in this respect to follow the procedure of the founders of the great cattle breeds. The system, too, would necessitate the trap-nesting of the hens and the keeping of careful records of all matings.

NOTE.—For readers who are familiar with the Mendelian theory and notation, the following brief note is added, but with the premise that the explanation depends on an acquaintance with some of the more recent Mendelian hypotheses dealing with the 'hybrid' nature of sex and the reduplication of certain gametic combinations in preference to others.—

The hypothesis is that high fecundity is determined by the presence of two unit characters (L_2 and L_1) with their corresponding absences (l_2 and l_1); that females are Ff and males f f; and that, when L_2, l_2, F and f are all present in the zygote, the gametes Fl_2 and fL_2 are formed in preference to FL_2 and fl_2. The allelomorphs L_1 and l_1, on the other hand, form gametes in accordance with the ordinary laws. The result is that hens laying over thirty eggs must all be taken as (Ff L_2 l_2 L_1 L_1), or (Ff L_2 l_2 L_1 l_1), that is to say, all must be heterozygous for L_2.

It follows (as in the classic case of *Abraxas*) that in gametogenesis the combinations Fl_2 and fL_2 must preponderate, and that, consequently, the presence L_2, is transmitted to sons in preference to daughters.

WEEDS IN RELATION TO SOILS.—NORFOLK.

WINIFRED E. BRENCHLEY, D.Sc., F.L.S.,

Rothamsted Experiment Station.

INITIAL investigations carried on in parts of Bedfordshire and the West Country * have shown that while definite relations exist between the weeds and soils of arable land, these relations are partly local and partly general in extent. It is evident that in some cases a weed that is symptomatic of a certain soil in one district is not so exclusively associated with it in another, but there are also indications that certain species are symptomatic or characteristic of the same type of soil in different districts. This report deals with the results of an investigation conducted in Norfolk, where much of the soil is of "drift" origin, having been derived from glacial deposits, and not from the rocks immediately underlying the soil, as was the case in the previous investigations. These drift soils are very varied in nature, all grades of light and heavy land being found within comparatively circumscribed areas.

During the season's survey 162 species of weeds, belonging to 104 genera, were identified, but of these, 36 species, representative of 32 genera, were each seen once or twice only. The number of species occurring was far greater than that in Bedfordshire or the West Country, though the number seen once or twice only was practically the same in each of the three districts. The strictness with which the various plants keep to their different habitats of field and hedgerow is most remarkable. A very few species, such as Hardhead (*Centaurea nigra*) and Scabious (*Scabiosa arvensis*), are denizens of both habitats, but otherwise it is very rare to find any incursion from one to another, even at the extreme edges of the fields. As heretofore, only the plants growing among the crops were considered as weeds. The classification of the weeds with regard to the soils they colonise is more difficult when dealing with the "drift" soils than with soils more directly derived. Well-marked soils, such as clay, chalk, and sand, are relatively scarce, while loams of all categories are most common.

* "Weeds in Relation to Soils," *Journ. Bd. Agric.*, xviii., p 18; xix., p. 20.

A. CLAY AND HEAVY LOAM.—Fields of this type were comparatively seldom seen, only about 11 per cent. of the total number being really heavy in nature. As is so often the case, while many species of weeds occur on the clay soils as well as in other habitats, only a few species have a decided preference for the heavy lands, and practically none can be designated as absolutely symptomatic of the clay, though a few are certainly characteristic. Of these the chief were: Field Foxtail (*Alopecurus myosuroides*), Cut-leaved Geranium (*Geranium dissectum*), Hogweed (*Heracleum Sphondylium*), and Corn Crowfoot (*Ranunculus arvensis*). Besides these, the Horsetail (*Equisetum arvense*), Dwarf Spurge (*Euphorbia exigua*), Cleavers (*Galium Aparine*), and Coltsfoot (*Tussilago Farfara*) were very frequent on these heavy lands, though they occurred on other types as well. One of the Mayweeds (*Matricaria Chamomilla*) was seen only on heavy loam and sand, and never on clay.

B. LOAMS.—By far the greater proportion of the soils investigated in Norfolk are loams, locally known as "mixed soils," varying in texture from light sand to soil of a very heavy nature. A local distinction is drawn between a "sand," and a "light mixed soil," and between a "heavy mixed soil" and a "clay," but this distinction does not hold good when the weed flora is considered. Between the lightest and the heaviest loams there is an intermediate range of loams with which certain weeds are more particularly associated. It seems as though some species of plants do not care for extremes of any kind, but flourish best in the less distinctive habitats. Among such species are Stinking Mayweed (*Anthemis Cotula*), Daisy (*Bellis perennis*), Petty Spurge (*Euphorbia Peplus*), Ryegrass (*Lolium perenne*), and Red Campion (*Lychnis dioica*).

C. SAND AND SANDY LOAMS.—These soils are met with all over the county; in some cases the sands are deficient in calcium carbonate, while in others, where the chalk rock comes near the surface, they are decidedly calcareous, containing chalk stones, as is well seen at Hargham and East Snettisham. The relative quantities of calcium carbonate in the sands are reflected in the flora, such so-called "acid" or "sour" plants as Sheep's Sorrel (*Rumex Acetosella*) and Spurrey (*Spergula

arvensis) never being found on the calcareous sands. In the present investigation sour soils other than sands have not often come into notice, so that it is not yet possible to say whether there is a flora that is characteristic of sour land of heavier texture.

The lighter soils are characterised by the great diversity of plants composing their flora, a good proportion of the species being definitely characteristic of sand and sandy loams. As has been found in other districts, Sheep's Sorrel, Spurrey, Knawel (*Scleranthus annuus*), and Corn Marigold (*Chrysanthemum segetum*) are symptomatic of light sandy soils which are very deficient in lime. Soft Brome (*Bromus mollis*), Viper's Bugloss (*Echium vulgare*), Field Alkanet (*Lycopsis arvensis*), and Early Forget-me-not (*Myosotis collina*) were only seen on sand, while Stork's-bill (*Erodium cicutarium*), Cudweed (*Gnaphalium uliginosum*), Yorkshire Fog (*Holcus lanatus*), Broad-leaved Dock (*Rumex obtusifolius*), Small-flowered Campion (*Silene gallica*), and Nettle (*Urtica dioica*) were characteristic of sand and sandy loam. Besides these, many other species are more or less closely associated with these types of soils.

D. CHALK AND CALCAREOUS SOILS.—Chalk is found underlying the "drift" soils over the greater part of Norfolk, but in the eastern and central parts of the county it is usually so deeply situated that it does not affect the surface soils. In West Norfolk, however, an outcrop occurs, so that in some places real chalky land is found, derived directly from the chalk rock, while in others the drift overlying the chalk is decidedly calcareous in nature, due to admixture with the chalky subsoil. Mugwort (*Artemesia vulgaris*), Chicory (*Cichorium Intybus*), Sun Spurge (*Euphorbia Helioscopia*), and Toadflax (*Linaria vulgaris*) are probably characteristic, while Fool's Parsley (*Aethusa Cynapium*), Hardhead, Thyme-leaved Sandwort (*Arenaria serpyllifolia*), Scabious, Cudweed (*Filago germanica*), Wild Mignonette (*Reseda lutea*), and Basil Thyme (*Satureia Acinos*) were all very common on chalky land, though they also occurred on sandy soils, or even on loam in some cases.

Widely-distributed Weeds.—While so many species of

weeds are more or less definitely associated with particular types of soil, many of the commonest plants are ubiquitous in their distribution. Creeping Bent-grass (*Agrostis stolonifera*), Shepherd's Purse (*Capsella Bursa-pastoris*), Mouse-ear Chickweed (*Cerastium vulgatum*), Fat Hen (*Chenopodium album*), Bindweed (*Convolvulus arvensis*), Carrot (*Daucus Carota*), Mayweed (*Matricaria inodora*), Plantains (*Plantago lanceolata* and *P. major*), Knotgrass (*Polygonum aviculare*), Dock (*Rumex crispus*), Groundsel (*Senecio vulgaris*), Chickweed (*Stellaria media*), and Creeping Buttercup (*Ranunculus repens*) are a few of the most familiar weeds that occur anywhere and everywhere on the arable land.

The weed floras of Bedfordshire, Norfolk, and the West Country are more or less comparable as regards the distribution of the plants, but the number of species found is considerably the greatest in Norfolk, partly because of the greater diversity in the soil and partly on account of the larger area covered by the investigation. Some few of the weeds are proving to have a real association with definite types of soil, while yet others show decided local differences in their distribution, being absent in one place from the very soil on which they are frequent or even characteristic in another locality. The calcifuge or chalk-hating plants vary somewhat in the different districts, but the Annual Meadow-grass (*Poa annua*) is conspicuous in being the only species that has so far proved to be consistently absent or very rare on chalk. The Dwarf Spurge and Corn Buttercup have always proved to be characteristic of heavy land, *i.e.*, heavy loam or clay. The Field Forget-me-not (*Myosotis arvensis*) is found on all soils in Bedfordshire, and is characteristic of chalk land in the West Country, while it is rare on chalk in Norfolk, thus providing a very good instance of "local" association of a weed with the soil.

Relations existing between the Weeds and the Crops.—After three seasons' work in the fields it is gradually becoming possible to interpret the earlier results in the light of the current year's work. The first impression obtained was that the crop played very little part in determining the weed flora, while the nature of the soil practically settled everything.

Leguminous plants were an exception to this rule, presumably because they tend to smother out certain weeds owing to their peculiarly leafy habit of growth, and also because certain other weeds seem to be habitually introduced with the seeds sown. It is now evident that while the soil is the primary determining factor, the nature of the crop plays a larger part than was originally supposed. While this influence is partly due to the different habits of the crops, it is probably more the result of the varying methods of cultivation applied to the crops. Broadly speaking, a four-course rotation is usually followed in the districts studied:—

(1) Wheat.
(2) Roots.
(3) Barley or oats.
(4) "Seeds" and leguminous crops.

With the seeds crops little is done to keep the land clean, so that the weed flora among the ensuing wheat tends to be specially fruitful in the species occuring in the young corn, though if the corn crop is very heavy it tends to choke out many of the weeds later on, a fact that is usually attributed to the exclusion of light and air. With the root crop comes the opportunity for a thorough cleaning of the land with cultivator and hoe, so that many species which cannot withstand such drastic treatment tend to be conspicuous by their absence among roots. Thus the barley and oats which follow after are able to make a fair start on clean ground, and the weeds therewith tend to be very few in number and species. The "seeds" crops present quite different conditions. No cultivation is possible among such crops as clover and lucerne, so that any weed seeds in the soil or introduced with the "seeds" have the opportunity to germinate and flourish undisturbed if only they can compete successfully with the overshadowing of the crop. Many species fail utterly to do this, and so are generally absent from seeds crops, while others seem to be specially adapted to grow under such conditions. Such plants as Spear Thistle (*Cnicus lanceolatus*), Cudweed (*Filago germanica*), and Cut-leaved Geranium were only found associated with seeds and legumes, while Mayweed (*Anthemis Cotula*), Nipplewort (*Lapsana communis*), Rough Meadow-grass (*Poa trivialis*), and Corn Crowfoot (*Ranunculus

arvensis) were only seen with cereal crops. On the other hand, Couch (*Agropyron repens*), Creeping Bent-grass (Twitch), Fat Hen, Cleavers (*Galium Aparine*), Knotgrass, Shepherd's Needle (*Scandix Pecten-veneris*), Dandelion, Ivy-leaved Speedwell (*Veronica hederaefolia*) are very rarely seen in seeds crops, while Field Foxtail, Red Bartsia, Mouse-ear Chick-weed, Wild Carrot, Corn Cockle (*Lychnis Githago*), and Mayweed are equally scarce among root crops.

The question arises as to how far impurities in the seeds sown affect the weed flora. Broadly speaking, the effect is not well marked. Of all the impurities indicated by Borlase * as occurring in leguminous seeds, *Geranium dissectum* is the only one which is associated with seed crops alone during growth. Annual Meadow-grass, which is introduced with the crop seed, is conspicuously absent in the mature crop. At present it does not seem possible to come to any conclusion with regard to this point. In the cereals so few weed seeds are sown that their effect is practically negligible.

Points of Special Interest.—(1) Two distinct weeds occur in Norfolk under the general name of Cudweed, *Gnaphalium uliginosum* and *Filago germanica,* the latter being found chiefly on light lands and chalk, while the former is characteristic of sand and sandy loam.

(2) At least four species of Mayweeds were found in the Norfolk fields. Of these *Matricaria inodora* was the only species that was found distributed on all kinds of soils, heavy as well as light, the others being practically confined to the lighter lands. *Anthemis Cotula* was generally a denizen of loams, *Anthemis arvensis* of sandy soils and chalk, while *Matricaria Chamomilla* was confined to either sand or heavy loam. Once again the Mayweeds proved very impatient of competition, as they were rarely to be found in and among the crops, but only at the edges and in open spaces, while they were always absent from root crops, where the additional factor of cultivation had to be competed with.

The table on pp. 204–5 shows the distribution of some of the most characteristic Norfolk weeds, a line ——— indicating absence or extreme rarity.

* Borlase, W., "The Study of Agricultural Seeds," *Journ. Bd. Agric.*, Vol. xix., No. 7, pp. 529–41.

No.	Latin Name	Common Name.	Clay and heavy loam.
1	*Aethusa Cynapium* ..	Fool's Parsley	———
2	*Agrostis stolonifera*	Twitch	Frequent .
3	*Alchemilla arvensis* .	Lady's Mantle ...	———
4	*Alopecurus myosuroides* ...	Field Foxtail	Characteristic . ..
5	*Anthemis arvensis*	Mayweed ...	———
6	,, *Cotula*	,, . .	Scarce
7	*Arenaria serpyllifolia* .	Thyme-leaved Sandwort	———
8	*Brassica Sinapis* . .	Charlock	Scarce . ..
9	*Carduus arvensis* ...	Creeping Thistle ..	Frequent . .
10	,, *nutans*	Dog Thistle	———
11	*Chenopodium album*	Fat Hen	Frequent . . ... .
12	*Chrysanthemum segetum*	Corn Marigold	———
13	*Convolvulus arvensis*	Bindweed	Very frequent
14	*Echium vulgare* ..	Viper's Bugloss	———
15	*Equisetum arvense* ..	Horsetail	Frequent ...
16	*Linaria vulgaris*	Toadflax	———
17	*Lychnis alba*	White Campion ...	Scarce ..
18	*Lycopsis arvensis* .	Field Alkanet	———
19	*Matricaria Chamomilla* .	Mayweed	Occasional
20	,, *inodora*	,, (scentless)	Occasional .
21	*Papaver Rhœas* ...	Poppy .	Scarce
22	*Plantago lanceolata* .	Ribwort Plantain . ..	Frequent .
23	,, *major* .	Greater ,,	Frequent .
24	*Poa annua* ...	Annual Meadow-grass	Occasional
25	*Polygonum aviculare* . .	Knotweed ..	Frequent . .
26	,, *Convolvulus*	Black Bindweed .	Occasional .
27	,, *Persicaria*	Persicaria	Scarce .
28	*Ranunculus arvensis* .	Corn Crowfoot .	Occasional ... ...
29	,, *repens*	Creeping Buttercup	Occasional
30	*Reseda lutea* .	Wild Mignonette	———
31	*Rumex Acetosella* ...	Sheep's Sorrel	———
32	,, *crispus* .	Curled Dock	Frequent .
33	,, *obtusifolius*	Broad ,,	———
34	*Scleranthus annuus* . ..	Knawel	———
35	*Spergula arvensis*	Spurrey . .	———
36	*Triticum* (*Agropyron*) *repens* ..	Couch	Frequent . .
37	*Tussilago Farfara* . . .	Coltsfoot . ..	Frequent
38	*Veronica agrestis*	Field Speedwell .	———
39	,, *hederæfolia* .	Ivy-leaved Speedwell	———
40	*Viola tricolor*	Wild Pansy	———

Loam.	Sand and sandy loam.	Chalk and calcareous soil.	No.
Scarce	Scarce	Occasional	1
Frequent	Frequent	Frequent	2
Frequent	Frequent	———	3
Occasional	———	———	4
———	Frequent	Frequent	5
Occasional	———	———	6
Frequent	Very frequent	Very frequent	7
Frequent	Frequent	Occasional	8
Very frequent	Very frequent	Frequent	9
———	Occasional	Occasional	10
Very frequent	Very frequent	Occasional	11
———	Characteristic of non-calcareous sand	———	12
Very frequent	Very frequent	Very frequent	13
———	Characteristic	———	14
Very frequent	Frequent	———	15
Occasional	Scarce	Characteristic	16
Occasional	Very frequent	Frequent	17
———	Characteristic	Scarce	18
———	Occasional	———	19
Frequent	Frequent	Occasional	20
Very frequent	Very frequent	Frequent	21
Frequent	Frequent	Occasional	22
Frequent	Frequent	Occasional	23
Very frequent	Frequent	Very scarce	24
Very frequent	Very frequent	Frequent	25
Very frequent	Very frequent	Occasional	26
Occasional	Frequent	———	27
———	———	———	28
Very frequent	Frequent	Occasional	29
———	Occasional	Occasional	30
———	Characteristic of non-calcareous sand	———	31
Very frequent	Frequent	Frequent	32
———	Occasional	———	33
———	Characteristic of non-calcareous sand	———	34
———	Characteristic of non-calcareous sand	———	35
Frequent	Occasional	———	36
Frequent	———	———	37
Very frequent	Very frequent	———	38
Frequent	Frequent	———	39
Very frequent	Very frequent	Frequent	40

EXPERIMENTS IN AGRICULTURAL CO-PARTNERSHIP.

"HOME COUNTIES."

VERY few experiments have been made in agricultural co-partnership. Three of the most important are proceeding in Essex at Terling, Southminster, and Dunmow.

I. *Terling and Southminster.*

The first experiment is being made on the dairy farm of 2,000 acres at Terling, near Witham, belonging to Lord Rayleigh, to which reference was made in this *Journal* for February last, Vol. XIX., p. 923 ("The Production of Clean Milk on Two Large Dairy Farms"). The farm is under the management of the Hon. Edward Strutt, late President of the Surveyors' Institution.

Twenty-two years ago Lord Rayleigh began paying annual bonuses to his men when the results of the year's farming justified it. The bonuses have been withheld on a few occasions only during years of depression, but have been paid regularly during the past eight years. The total sum paid in bonuses has been something like £10,000. The bonuses are received by all workers earning 7*s.* a week and upwards. An old age pension scheme dates about as far back as the bonus system, and, at the time of the introduction of national old age pensions, had about £2,500 to its credit. Mr. Strutt began the experiment in co-partnership in 1908.

How the System is Worked.—The bonuses had been paid into accounts started for the men in the Post Office Savings Bank. The recipients were free to deal with them as they pleased. Under the co-partnership scheme the bonuses are paid into accounts with the farm. The men are provided with pass-books, and are free to take out the investments or allow them to remain. They may add any savings of their own, their wives, or their children to the amounts standing to their credit. On the total amounts invested interest at the rate of 4 per cent. is paid, plus such dividend as is earned by the farm after expenses of management, rent to Lord Rayleigh, and interest on his capital have been met. The average earnings of the men, reckoning cowmen and labourers only, are about 17*s.* 6*d.* weekly, not including bonuses or interest on investments.

For 1912 the value of the bonuses paid to 260 workers was £626, the amounts ranging from thirty shillings in the case of lads up to three or four pounds in the case of skilled labourers, and even ten pounds in the case of bailiffs. In the same year interest and dividends called for the payment of £412 odd. In the first year of the scheme the amount was only £95 owing to the small amount invested. Every year more workers leave their money with the farm. The number in 1912 was 152, and the total sum invested amounted to £3,799.

About half the investors are married. In the following list of investments for 1912, the larger amounts represent the investments of bailiffs or clerks, but one young labourer has accumulated more than £100, the amount being composed of his savings, bonuses, and interest exclusively.

LIST OF INVESTMENTS.

Amount.			Amount.			Amount.			Amount			Amount.		
£	s.	d.	£	s.	d.	£	s.	d.	£	s	d.	£	s.	d.
13	8	8	483	13	6	867	6	8	1,893	13	11	3,061	4	2
21	15	4	28	13	9	18	13	10	31	11	10	10	0	0
22	8	3	42	4	4	5	6	7	205	5	6	13	13	5
15	13	4	54	19	9	5	2	9	22	2	8	2	17	4
8	18	5	12	2	8	3	17	7	4	12	8	2	14	11
10	1	5	23	6	5	3	4	0	5	18	6	2	14	2
12	18	8	12	15	4	3	2	8	5	2	9	98	19	6
17	17	2	25	18	7	8	0	4	2	3	11	59	5	7
17	8	6	5	11	6	16	17	7	7	10	11	23	9	2
4	11	7	6	17	2	7	4	5	4	0	4	38	10	9
3	8	5	6	17	2	6	15	5	5	2	9	1	6	4
5	2	9	6	17	2	20	16	10	6	17	2	6	13	8
2	17	4	6	17	2	40	6	7	38	13	8	4	8	7
4	16	3	6	17	2	84	2	9	23	0	4	8	19	11
5	2	9	5	2	9	16	3	6	17	16	5	3	12	1
5	2	9	5	2	9	6	17	2	31	12	5	6	14	2
5	2	9	5	2	9	4	9	10	16	16	7	6	2	9
6	7	0	3	8	8	5	2	9	16	10	4	56	3	3
2	17	1	6	4	1	4	17	10	13	5	1	65	13	6
20	7	5	5	2	9	8	6	0	6	17	2	53	4	10
2	14	11	4	0	0	65	10	10	5	2	9	21	8	7
3	5	9	2	9	11	106	14	2	3	8	5	41	9	5
6	17	0	14	8	9	5	2	9	90	14	3	101	19	8
16	13	1	14	19	3	2	2	0	17	5	3	-	11	4
90	5	3	9	14	1	287	11	4	32	0	6	3	7	1
7	8	1	8	17	7	139	18	10	10	5	9	5	6	3
5	2	9	18	11	0	18	2	2	175	10	6	4	18	1
18	0	1	12	18	8	16	12	6	6	0	1	6	17	2
13	10	10	7	5	10	47	12	6	273	7	4	6	17	2
21	15	8	4	2	5	37	19	11	85	14	5	29	8	5
91	14	3	16	3	9	29	11	10	3	0	0	47	8	10
												3	4	0
483	13	6	867	6	8	1,893	13	11	3,061	4	2	3,799	4	1
Carr. forward			Carr. forward			Carr. forward			Carr. forward					

Investments may be withdrawn at a month's notice, and are also payable on a man leaving Lord Rayleigh's employment. The withdrawal form used is as follows:—

WITHDRAWAL FORM.

Terling Estate: Share No.......

........................., 19...

I hereby give you notice that I wish to withdraw the sum of £ : : .

Signed......................

Special care is taken to preserve secrecy as to the men's accounts.

The pass-books given to each shareholder are ruled as follows:—

PAGE FROM A PASS-BOOK.

Date of Deposit.	Amount Deposited	Amount Withdrawn	Balance	Date of Withdrawal	Signature of Cashier
	£ s d	*£ s d.*	*£ s. d*		

Result of the Scheme.—There is no disposition at Terling to over-estimate the favourable results of co-partnership. But Mr. Strutt has no doubt that there has been "more willing service" and "perhaps a greater readiness to accept new methods." He is sure "the plan is a good one, and the right thing to do." The steward and the bailiffs are equally well satisfied. There is, they think, "less friction and more interest in the work."

The fact that Mr. Strutt has introduced co-partnership on the farms at Southminster, Essex, worked by the firm with which he is connected, Messrs. Strutt and Parker, is excellent testimony as to the working of the Terling scheme. At Southminster some forty men have £2,500 invested.

Working of the Farm.—In considering the results of co-partnership at Terling it is fair to take some account of the

effect, not only of the judicious assistance which has been given in the village to various ameliorative agencies, but of the high degree of efficiency with which the farming is carried on.

There is a good school, and, by way of recreation, cricket, quoits, and rifle shooting—there are more than two dozen men in the Territorials; a recreation committee provides illustrated lectures, concerts, the cinema, and dancing, while a swimming bath is hoped for. A public-house has had its license extinguished, and has been turned into a club. Very few young men leave the village.

With regard to the working of the farm, opportunities of promotion are before the eyes of the employees, and at a meeting of the heads of departments, which is held every week, suggestions for the benefit of the estate are considered from any of its workers. The statistics given in Mr. Strutt's presidential address at the Surveyors' Institution, November 11th, 1912, illustrate the character of the management of the farm. These figures showed that, taking the period 1906–11, the annual profit had been as follows: cows, £972; cattle, £54; sheep, £22; poultry, £111. There was a loss of £31 on pigs. On crops during the same period the annual profit per acre had been: wheat, £3 17*s.*; barley, £2 7*s.* 9*d.*; winter oats, £3 0*s.* 1*d.*; spring oats, £2 4*s.* 8*d.*; beans, £1 11*s.* 11*d.*; peas, £3 3*s.* 8*d.*; swede and mangold seed, 18*s.* 6*d.*; red clover, £2 14*s.* 4*d.*; sainfoin, £1 14*s.* 8*d.*; lucerne, £1 1*s.* 3*d.*; rye, tares, and trifolium, 3*s.* 7*d.*; mangolds, £1 12*s.* 5*d.*; potatoes, £6 2*s.* 9*d.*; cabbage, kohl-rabi, &c., 2*d.*; maize, £1 6*s.* 6*d.*; and permanent grass, 6*s.* 6*d.* The land is three-fifths rather heavy arable and two-fifths pasture.

II. *Dunmow.*

In 1910 Messrs. Hasler and Clapham, farmers and corn, seed, and coal merchants, Dunmow, started a co-partnership scheme. The area of the land farmed is about 600 acres, and the number of men employed in all about 80. The system of co-partnership is somewhat different from that in operation at Terling.

When wages and all other expenses, partners' salaries, and the appropriations for depreciation and reserves are met, the

profits of the firm are disposed of in the following manner. In the first place, 5 per cent. is paid on the firm's capital and on any borrowed capital. The balance of profit is then divided between employees and the firm at a *pro rata* percentage on the amount of wages paid and the average amount of capital employed in the business during the year. The men's percentage is called their bonus. Only employees who have been a year with the firm share in the distribution. Deposits are received from the men, 5 per cent. being paid. All deposits are withdrawable on demand.

Effect of the Scheme.—The first year there stood to the men's credit, in bonuses and deposits, the sum of £550. During the second year the bonuses paid amounted to £348, the total amount deposited being £756. The amount withdrawn by the men had been £250. While, obviously, the actual figures of capital and profit in the business cannot be stated, it may be said, in order to make the working of the scheme quite clear, that if the amount of capital is assumed to be £9,000, the amount paid in wages to be £1,000, and the amount of profit available for distribution to be £500, then £450, or nine-tenths, is the employers' share, and £50, or one-tenth, is the employees'. The average earnings of able-bodied men, with their bonuses, work out at over £1 a week.

The following table shows sums received in bonuses in the first year of the scheme by men earning different wages:—

Wages.	Bonus	Wages.	Bonus
£	£ s. d.	£	£ s. d.
22	1 17 5	46	3 18 3
23	1 19 0	47	4 0 0
24	2 0 10	48	4 1 7
39	3 6 3	50	4 5 0
41	3 9 9	51	4 6 9
43	3 13 1	54	4 11 10
44	3 14 9	59	5 0 4
45	3 16 6		

Where the wages are £20 odd, the recipients are lads. The bonus addition to wages in the first year of the scheme was a little more than 8 per cent.; in the second year the rate was over 13 per cent. This year it will be 11 per cent. Mr.

Hasler is of opinion that the result of the co-partnership experiment is that the men have shown greater keenness and more interest in the success of the business, and that implements have been better looked after.

Terling, Southminster, and Dunmow Schemes Compared. —It will be seen that, as to bonuses, under the Terling and Southminster schemes, the amount of bonus distributed is determined by the employer. The Dunmow plan, on the other hand, provides for a bonus consisting of a fixed percentage of such profit as is earned by the firm.

As to the men's investments, the Terling and Southminster men are shareholders in a business, and are guaranteed 4 per cent. on the amounts standing to their credit; and they may receive, and always have received, more than that, that is, their 4 per cent. plus the dividend declared by the firm. The position of the Dunmow men is that they receive a fixed 5 per cent. on their deposits, but no dividend in respect of this contribution to the firm's capital.

The accounts of the Dunmow firm are audited for the purposes of the co-partnership by an accountant from a distance. It will be seen that neither in Mr. Strutt's nor in Messrs. Hasler and Clapham's scheme is any provision made for the men to have any voice in the direction of the firms in which they have been given a financial interest.

For the benefit of anyone investigating the working of agricultural co-partnership in Essex, it may be added that Messrs. Wilkins, fruit growers and jam manufacturers, of Tiptree, have a system of co-partnership dating from 1910.

In 1912 the Board of Trade issued a Report on Profit Sharing and Labour Co-partnership in the United Kingdom (Cd. 6496, price 8½*d.*), which, by reason of its detailed account of various types of schemes, will be serviceable to those contemplating experiments.

AGRICULTURAL EDUCATION IN SCANDINAVIA.*

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Agricultural Education in Sweden.

There is probably no country in the world where agricultural education is better organised and more appreciated than in Sweden, and the result of this is apparent in the rapid improvements which have taken place in all branches of agriculture, among which dairying takes a particularly prominent place. Such education is in close touch with research of the most advanced character, the two chief centres for this being at Stockholm and Svalöf, the latter having attained world-wide repute in connection with plant-breeding.

Royal Academy of Agriculture.—The Royal Academy of Agriculture, founded in 1811, is more particularly identified with research, but was formerly also the chief administrative authority, a position now occupied by the Board of Agriculture, which dates from 1890.

Agricultural Colleges.—There are two agricultural colleges, one at Ultuna, near Upsala, founded in 1847, and the other at Alnarp, in South Sweden, founded in 1862. Both these institutions are well equipped and fully staffed. The new buildings at Ultuna, towards the cost of which a Government grant of £5,555 was made in 1911, are well suited to their purpose. The main building at Alnarp is less satisfactory, but the attached schools of dairying, farriery, and horticulture are well provided in all respects, and there is an excellent botanic garden.

Both colleges give the highest type of agricultural instruction, with the aim of making rational and capable agriculturists. The course extends over two years, and the instruction is theoretical, but a year's farm experience is one condition of entry, others being the possession of a leaving certificate from a secondary or technical school, and the attainment of a minimum age of eighteen years. There are between forty and fifty students at Ultuna, and between thirty and

* This article is substantially a report submitted to the Governors of the Usk Farm Institution.

forty at Alnarp. These numbers do not include those studying in the attached schools of dairying. The tuition fee is £9 14*s*. per annum, and each student also pays for his board at the rate of about 12*s*. per week. Some students hold bursaries, and others have free places.

The subjects taught are those usually included in a college curriculum, but stress is laid on breeding and improvement of stock. Political economy is also taken. During the course, visits are paid to factories connected with industries related to agriculture, and towards the end of the second year a week is spent in visiting various farms noted for high cultivation or good stock.

At the end of the course there is an examination, and students desiring educational posts or official positions in connection with agriculture must possess a certificate showing they have passed this.

A small number of students prolong their course beyond the second year, and are then required to take part in the teaching. At Ultuna two free places are reserved for this purpose, each carrying an honorarium of £16 13*s*. 4*d*. per annum.

An area of 1,297 acres of land is attached to Ultuna, and of 1,334 acres to Alnarp, in each case under the control of a farm manager, who is independent of the college and responsible for the model cultivation of his farm. From the practical point of view the colleges are well placed in this respect, Ultuna being on the very strong clay characteristic of Central Sweden, while Alnarp is on lighter soil in the most fertile and best farmed part of South Sweden.

A farm school is attached to each of the two colleges, and at Alnarp there are also schools of dairying, farriery, and horticulture.

Apart from house-keeping, the expenses of upkeep are:—

Ultuna—rather more than £3,000 per annum;
Alnarp— „ „ £4,000 „ „

Farm Schools.—Farm schools, of which there are at present twenty, exist in almost every province, and one of them is attached to and managed by each college. The aim of such a school being to train bailiffs and foremen, special stress is laid on practical work, and the pupils carry out all, or at

any rate the more important parts of, the farm work on the attached holding, and perform in turn the duties of bailiff. The holdings of the eighteen schools not attached to colleges range from 90 to 2,287 acres in extent.

The theoretical instruction, which occupies four hours a day during the winter, includes most of the subjects taken in colleges, but is necessarily of a simpler character. The course is of two years' duration (only one year in four of the most northerly provinces), and the conditions of admission are:—(1) Sound physical health; (2) minimum age of eighteen years (many pupils are much older than this, up to 32: average age about 22); (3) ability to read, write, and understand the first four rules of arithmetic; and (4) possession of at least one year's practical farm experience. Young men, having in addition a theoretical knowledge equivalent to that of the first year, can be admitted as second year students.

There is a fixed Government grant of £111 or £222 per annum, increased to £333 in the case of the three most northerly schools. In some cases paying students are admitted in limited numbers, but most students receive free tuition, with board and lodging, and enough money to pay for clothes and books.

During the year 1909–10 the number of students ranged from nine to twenty-four per school, while there were twenty-eight in the Ultuna Farm School, and forty-four in that at Alnarp. The total number of pupils was 343.

Agricultural or Farmers' Schools.—These differ from the preceding in making provision for those actually engaged in agricultural work, who can only spare part of the year for improving their education. In this respect they resemble the Hampshire Farm School at Basing, and much of the work they do is of the kind contemplated for farm institutes in England and Wales, except that the instruction is theoretical and there is no land attached. There are thirty of these Farmers' Schools in Sweden, and they usually form a special part of the work of the People's High Schools, which provide further general education for adults and are peculiar to the three Scandinavian kingdoms and Finland. The work of the Farmers' Schools is, in fact, based on, and an extension

of the general training given in the People's High Schools. The aim is to improve the practice of farmers by giving them instruction in agriculture and related subjects.

Candidates for admission must be healthy and of at least 17 or 18 years of age (exceptionally 16 only), must possess such general education as can be obtained at a People's High School, and must have had at least one year's experience of practical farm work.

During the year 1909–10 the thirty schools were attended by 476 pupils, of whom 266 paid their own fees. The number of students per school ranged from four to forty-four. The ages of pupils varied from 16 to 33, the average being a little over 21½. The Government grant is from £166 6*s*. 8*d*. to £222 per annum for each school, and at least an equal sum must be raised locally. The State reserves the right of disposing of a free place for every £55·10*s*. of grant, and also gives about £555 per annum in bursaries.

A typical Farmers' School, visited by the writer, is situated at Svalof, in South Sweden (Scania), and forms a part of the Fridhem People's High School. There is nothing remarkable about the buildings, which, as in other cases, are mostly constructed of wood, except the existence of a well-appointed gymnasium, in accordance with the Swedish views on the importance of physical training.

The winter course held in 1911–12 was attended by thirty-two pupils, of an average age of nearly twenty-two, and of whom four were women. Work began on November 1st, 1911, and ended on April 12th, 1912. The Christmas vacation lasted from December 23rd, 1911, until January 8th, 1912. The time-table shown on p. 216 was followed.

The gymnastics, singing and debate were taken in common with the ordinary pupils of the High School. The German was optional. Director Wiström, with five assistants, gave the instruction. Excursions took place during the course to the Svalöf Plant-breeding Station, a dairy farm, a poultry farm, a public slaughter-house, a superphosphate factory, and a sale of breeding stock. Lectures by various specialists were given on wall-fruit, swine husbandry, roots, and poultry farming.

The tuition fee for the winter course was £2 15*s*. 6*d*.

There are free places, and bursaries of £7 10*s.* (for poor students) and of £4 3*s.* 4*d.* (for those of small means). There are also two travelling bursaries of £5 11*s.* each.

The summer course of household economy, for women, was held from May 1st to August 31st, 1912. There were six special students of the average age of 20½, working together with a number of ordinary High School pupils. The practical instruction included cookery and related business transactions, and baking of various kinds. Each pupil in turn

	7.50—8	8—8.45	9—9.45	10—10.45	11—11.45.	2—2.45.	3—3.45.	4—4.45.	5.15—6
M.		Farm Stock	Swedish			Veterinary Science	Farriery	Zoology	Debate
Tu.		Agriculture	Physics	Botany and Forestry		Farm Stock	Citizenship	Economics.	Singing
W.		Farm Stock	Book-keeping		Gymnastics	Agriculture	Chemistry	Local Administration	
Th.	Prayers	Geology and Agriculture	Drawing			Building, Construction, and Drawing		Farm Stock	Optional Work
F.		Farm Stock	Arithmetic			Agriculture	Swedish		Singing
S.		Geology and Agriculture	Dairying	Chemistry	German	Free			

was responsible for the preparation and conduct of a dinner. The theoretical instruction included the nutritive value of different foods, dietaries, food preservation, tests of fitness or unfitness of food for human consumption, domestic economy, cost of meals per head, care of the home, and rules of health. The pupils also received instruction in hygiene, chemistry, physics, book-keeping, care of farm stock, dairying, zoology, singing, and gymnastics. The tuition fee for the summer course is £1 13*s.* 4*d.*

A short course in household economy, for women living on small holdings, was held during the afternoons from March 11th to 23rd, 1912, and was attended by thirty-five pupils, of the minimum age of 18. Of these, twenty-one were free pupils, while each of the others paid 5*s*. 6*d*., to cover the cost of materials used in teaching. The instruction included ten demonstrations in cookery and two in dairy work; four lectures on food, two on domestic hygiene, two on gardening, two on the care of stock, and two on book-keeping.

A six weeks' course in agriculture for elementary teachers was given from June 25th to August 3rd, 1912, to seven pupils. No less than ten lecturers took part in the instruction, and four lectures were delivered every morning, the afternoons being devoted to excursions and open-air demonstrations. The following subjects were included:—Soils and manures, improvement of pastures and root-crops, recognition of seeds and seed control, farm stock, care of domestic animals in health and disease, swine husbandry, poultry farming, book-keeping, farm buildings, chemistry, zoology, and economics. Special attention is called to this course, for elementary teachers give the only education compulsory for the children of farm labourers. Saturday classes on the above model, or still better vacation classes, could be conducted with advantage at farm institutes.

The cost of a bedroom at the Fridhem School is £2 15*s*. 6*d*. for the winter course, and £1 13*s*. 4*d*. for the summer course, these charges being halved if two students share the same room. The bedrooms are rather small and very simply appointed. Students bring their own mattresses and bedclothes.

Full board costs £1 19*s*. per month, or 1*s*. 5*d*. per day, while 8*d*. is charged for a single dinner. Service and light are included.

The Swedish system of education also provides for instruction in dairying, veterinary science, farriery, horticulture, forestry, the peat industry, fisheries, and economics, besides which there are itinerant agricultural schools, and specially arranged tours for small holders. Another very interesting kind of educational work is now being developed, *i.e.*, instruction in the methods of fruit-bottling, preparation of dried

fruits and vegetables, jam-making, preparation of fruit syrups, &c., by means of travelling vans fitted up with the necessary apparatus. One point here kept in view is the utilisation, so far as possible, of wild fruit and berries. A summer course in these subjects for women teachers is given in Stockholm, and the writer had the opportunity of seeing the appliances used and discussing the methods of instruction with the teacher.

Agricultural Education in Norway.

Agricultural education is organised in Norway in much the same way as in Sweden, and the chief permanent Government official for agriculture is the Director for Agriculture.

Agricultural College.—The centre for research and higher instruction is the very fine agricultural college at Aas, near Christiania, which celebrated its jubilee on September 25th, 1909, when the King of Norway was present, and marked his appreciation of the services rendered to agriculture and allied industries by the college by ordaining the award of a gold medal for scientific research in agriculture.

The ordinary course is of two years' duration, except in the case of forestry students, who take three years. During the first year all students pursue the same curriculum, which includes: mathematics, land surveying, physics and meteorology, chemistry, mineralogy and geology, botany, zoology, soils, drawing, book-keeping and economics. Students of forestry and horticulture also begin their main subject. During the second year some of the subjects are taken in common, but the students are divided into sections with specialised work, *i.e.*: (1) agricultural section; (2) surveying section; (3) horticultural section; (4) dairy section.

Special courses given at the college include:—

(1) A one-year course for herdsmen;

(2) A one-week course for farmers, including twenty-three lectures, together with various outdoor demonstrations;

(3) A twelve-day course for elementary teachers, including thirty-one lectures, associated with outdoor demonstrations;

(4) A fortnight's course on the use of fruit and vegetables, including twenty-seven lectures, together with demonstrations.

The lower grades of agricultural instruction are organised

in Norway on much the same lines as Sweden, but, as the writer had no opportunity of acquiring first-hand information, no details are given.

Housekeeping Schools.—These schools form an interesting and important feature of Norwegian education. During the year 1910–11 there were twenty-nine of these in activity, giving instruction to 973 pupils, a large number for a country with a total population of 2,400,000, somewhat less than that of Wales together with Monmouthshire. The writer visited a typical school of the kind when it was in full work, *i.e.*, the Christiania School of Household Economy, under the direction of the Norwegian Women's Association. This school is pleasantly situated in a square in the centre of Christiania, and has apparently been made by uniting three ordinary dwelling houses.

There are two courses of five months' duration in the year, open to young women of all classes, ranging in age from 18 to 30, most of them being from 18 to 20. The pupils mix freely together without regard to class distinctions, as might be expected in so democratic a country as Norway.

The object of the school is to train young women of all classes to discharge with economy and ability the duties which fall to the lot of a married woman, housekeeper, or servant, and at the same time to awaken a spirit of responsibility and self-reliance.

The premises are arranged like a comfortable home, and include a large parlour with piano, a large dining-room, properly ventilated and furnished bedrooms, and a bathroom. There are large, well-equipped kitchens, a large bakery, larder and pantry, brewery, and commodious rooms for laundry purposes. There is also a good library, with newspapers and periodicals.

The instruction includes:—Foods, two hours per day; hygiene, one hour per day; household chemistry, one hour per day. The household economy of the school is carried out by the pupils, the students being divided into five groups of six each, and every student is assigned special work, which changes every eighth day, giving about five weeks' practice in each department of kitchen work.

The time-table is as follows:—Rise at 7; breakfast, 8;

prayers, 8.30; theoretical instruction, 9–10; second breakfast, 10–10.30; cookery, 10.30–2; dinner, 2; tea, 4.30; supper, 8.

The course also includes visits to museums, factories, the agricultural college at Aas, &c. The free time allows of attendance at university lectures, theatres, and concerts. There is also sufficient leisure in the afternoon for walking, and preparation for the next day's work.

The charge for tuition, board and lodging during the whole of a five-months' course is £19 8*s*. Laundry is an extra. Each pupil on entry pays 3*s*. 4*d*. to the sick-room fund.

Agricultural Education in Denmark.

Denmark is well known as a pioneer in agricultural education, and its methods have often been described. The People's High Schools, with the associated Farmers' Schools in Sweden, of which a brief account has been given above, have been established on the Danish model. The writer visited the Royal Veterinary and Agricultural College in Copenhagen and the Farmers' School at Lyngby, near that city.

The Royal College—the only higher institution of the kind in Denmark—is very well off as regards buildings, equipment, botanic gardens, and so forth. It began work in 1858. During the year 1909–10 there were twenty-three professors with ten lecturers and numerous juniors on the teaching staff. Active research is carried out in many departments, Prof. Bang's work on tuberculosis being that most widely known.

The college trains veterinary surgeons, agriculturists, land surveyors, horticulturists, and forestry experts. The first year's instruction is to a very large extent taken in common by all classes of students, and after this specialisation begins. The veterinary course is 4½ years, the agricultural course 1⅚ years, the surveying course 3¾ years, the horticultural course 2⅙ years, and the forestry course 3½ years. There are also a one-year continuation course for veterinary surgeons, a continuation course of 1⅚ years in rural economy (for teachers and inspectors), and a two-months' course in farriery.

The Farmers' School at Lyngby is side by side with the People's High School there, which is the pioneer institution of the kind, but the two are under separate management.

There are two courses, both for young men, one lasting six months and the other nine months. A maximum of ninety pupils can be received, and fifty to sixty of these take the six-months' course.

The following subjects are taken in the six-months' course (November till May):—Inorganic and organic chemistry, physics, soils, tillage, manures, rotations, crops, weeds, study of seeds, plant diseases, structure and functions of farm animals, breeds of farm stock, animal husbandry, stock-judging, foods and feeding stuffs, animal diseases, farriery, dairying, farm accounts, implements and machines, drawing, surveying and levelling, arithmetic, agricultural calculations, history of Danish agriculture, and defects in stock.

The same subjects are taken in the nine-months' course, but are carried somewhat further, and the following are added:—Practical chemistry, theoretical and practical botany, and economics.

The time-table is as follows:—Coffee, 7.30; instruction, 8–12; dinner, 12; instruction, 1.15–3.45; afternoon coffee, 3.45; independent work, 5–9, with interval for supper at 6.30; reading aloud (optional), 9–10.

The instruction is given by the Director, assisted by nine members of the staff. During the winter half-year members of both courses take part in gymnastics.

About seventy acres of land are attached to the school for experimental purposes.

As regards fees, tuition, board and lodging cost on the average £2 4*s*. 5*d*. per month. Non-resident students pay £1 per month for tuition, and those in the nine-months' course a laboratory fee of 4*s*. 5*d*. per month during four months.

The school receives a Government grant of £166 13*s*. 4*d*. per annum. Bursaries or free places are available for deserving students.

The writer desires to express his indebtedness to the British Ministers in the Scandinavian capitals; Director Tandberg, of the Norwegian Board of Agriculture; Professor Dannfelt, Secretary of the Royal Swedish Academy of Agriculture; Messrs. Vallö and Schou, of the Danish Board of Agriculture; and the staffs of the various institutions visited.

RURAL PARTY LINE TELEPHONES.

THE Board desire to call the attention of farmers and others to the facilities now offered by the Postmaster-General for the co-operative use of a telephone service, which, from several points of view, should prove of very great value to residents in rural districts.

The Postmaster-General has issued a memorandum on this subject in which it is stated that residents in rural districts are apt to think that a telephone is a luxury of town life which it is impossible to enjoy in the country except at a high cost. This is true if each person requires a separate exchange line, consisting of two wires over the whole distance between the exchange and his residence, to be provided for his exclusive use, but such a line is not necessary in order to enjoy most of the advantages of the telephone service. If a sufficient number of subscribers living on or near a country road leading to a town where there is a telephone exchange will agree to use one line, they can telephone as much as they please to people on that exchange for a moderate fixed charge which ranges from £3 to a little more than £3 10*s*. per annum according to the number of subscribers.

In the United States there are to-day more telephones in use by farmers than the whole number in use by the commercial and all other classes in the United Kingdom, and these telephones are found to add to the profits and comfort of the farmers to an extent which makes the cost of the telephones seem negligible.

The Postmaster-General is ready to provide lines of the same kind in the rural districts of the United Kingdom. By means of such a line a farmer can speak from his farm to all the people who are telephone subscribers with whom he does business, not only in the nearest town, but also as a rule in all places within a distance of about 100 or 150 miles. He can also send messages and receive replies by telephone when his correspondents are not telephone subscribers, or he can get them to speak to him from a public call office. If a machine is broken he can order a new part without the trouble of a journey into the town or the delay of sending

an order by post. He can get the latest information as to market prices, and arrange to the best advantage for the sale of his produce and stock, and he can get any weather reports and forecasts which he may want to guide him when crops have to be gathered. In the case of illness a doctor can be summoned, or a veterinary surgeon for his horses and cattle. If a fire occurs assistance can be called. He can speak to any neighbouring railway station and arrange for the despatch or delivery of his goods and produce. He can despatch a telegram without the trouble of sending a messenger to the telegraph office, he can receive his telegrams by telephone without waiting for a messenger to bring them out, and he can also call a messenger to take an express letter. In a short time the telephone becomes the most valued implement of the farm.

Co-operative movements among farmers for the use of central dairies and creameries, or for the collection and distribution of produce, can only be worked to the best advantage if a telephone service is available to bring the farms of members into direct communication with the central establishments.

If a farmer has a telephone he can in a few minutes, when he is at home for breakfast, dinner, or supper, do business which otherwise would involve inconvenient and expensive journeys to neighbouring towns, or which he could not do at all owing to the delay involved in reaching the other parties concerned. When his work is over, he and his family can talk to their friends and neighbours, and can even arrange social meetings which would otherwise be impossible. In many other ways, too numerous to mention, the telephone helps him to overcome the chief drawbacks of country life and enables him to do business on as good a footing as if he lived in a town.

Those who would like to have a telephone service of this kind in their district, should write to the Secretary, General Post Office, London. They should first, however, try to interest their neighbours in the scheme, and find out how many are willing to join at the rate of £3 per year for unlimited calls on their own exchange, and with the power of talking to other towns at the rate of 1*d*., 2*d*., or 3*d*. per

conversation, according to the distance for towns within 25 miles, and at the rate of 6*d*. for towns within 50 miles.

Particulars of the rental and other charges, and the general conditions relating to rural party lines for the use of farmers and other residents in rural districts are as follows:—

I.—Rate of Subscription.

£3 per annum per telephone, provided that not fewer than three telephones are rented by subscribers on each party-line, and that on an average there are three telephones to each mile of line. With two subscribers per mile the rate is £3 10*s*. a year, and, in exceptional instances, where there are less than two subscribers per mile, lines are provided at a somewhat higher charge. The first half mile from the exchange is not counted in the length of the line.

II.—Particulars of Service.

Exchange Calls.

The subscription covers an *unlimited number of calls* to other subscribers whose telephones are connected with the same exchange.

Calls to Other Exchanges.

Calls to subscribers connected with other exchanges can be made at the following fees:—

Day Service Charge. (7 a.m. to 7 p.m.)	Night Service Charge. (7 p.m. to 7 a.m.)
Up to 25 miles—1*d*., 2*d*., or 3*d*. for 3 minutes...	1*d*., 2*d*., or 3*d*. for 6 minutes
26 to 50 miles—6*d*. for 3 minutes	6*d*. for 6 minutes
51 to 75 miles—9*d*. ,, ,, ...	6*d*. ,, 3 ,, 9*d*. ,, 6 ,,
76 to 100 miles—1*s*. ,, ,,	6*d*. ,, 3 ,,
Every additional 40 miles or part thereof—6*d*. for 3 minutes	3*d*. ,, 3 ,,

Other Conditions.

(*a*) It is essential that a *sufficient number of subscribers* whose residences lie in the same direction from the exchange should be willing to share a party-line.

(*b*) Subscribers can co-operate to keep the working of the system thoroughly effective by replacing their receivers as soon as, on entering the circuit, they hear that another conversation is going on, and by not prolonging conversations unnecessarily at a time when other subscribers may want to make use of the facilities.

(*c*) It is essential that subscribers should assist the Post Office by granting any wayleaves on their property that may be necessary.

Further information on the subject of Rural Party-lines can be obtained from The Secretary, General Post Office, E.C.

THE RED CLOVER GALL GNAT.

Amblyspatha ormerodi nov. sp. Kieffer.

R. STEWART MACDOUGALL, M.A., D.Sc.

A FEATURE of the past winter and spring has been a great destruction of Red Clover (*Trifolium pratense*). Complaints of the dying of red clover reached the Board of Agriculture and Fisheries in the month of November and continued through December, January, February and March. The counties that suffered most were Norfolk, Suffolk, Essex, Lincoln, Huntingdon, Cambridge, and Surrey, and in the West, Hereford and Shropshire. Typical statements may be quoted from the letters of complaint. "Attack began to show about November" (Huntingdon). "The disease has frequently destroyed the whole of the crop between now and the end of April" (Hereford). "The clover was sown among oats in the spring of 1912, and was looking extremely well in September and October, but afterwards became patchy, square places one yard or more in size being diseased all over the field" (Woodbridge). "The disease commenced with small patches, which have gradually spread all over the field; it is worst where sheltered by trees, and in low-lying parts of the field. The same disease has been noticed in other years, but not to the same extent" (Cambridge).

In practically all the samples received red maggots were found either in the soil surrounding the plants or—on dissection—in the spoiled plants. The red maggots were those of a Cecidomyid; they were similar in appearance to specimens which I had received in a previous year, and I have satisfied myself from a comparison of the maggots that they are the same as were sent to the late Miss Ormerod as present in Red Clover and mentioned by her in her Report for 1889. Till now the species has remained unknown, but I succeeded in breeding out a number of the adult flies from various

diseased plants. These flies were submitted to Professor Kieffer, the European authority on *Cecidomyidæ*, and he determines the new fly as *Amblyspatha*. I have named the species *Amblyspatha ormerodi*, Kieffer.

Miss Ormerod, in her Report for 1889, did not consider the red maggots as directly harmful to the clover plants, and the present infestation is complicated by the fact that in nearly all cases the eelworm *Tylenchus devastatrix* was present. The following table represents what was found in or about the clover plants that were submitted for examination, P signifying "present."

No.	Amblyspatha ormerodi.	Tylenchus devastatrix	Enchytraeid Worms.	Larva of Camptocampus aterrimus, a Chironomid	Larva of Sciara.	Larva of Sitones.	Collembola	Sclerotinia Sclerotiorum.
1	P	P	—	—	—	—	—	—
2	P	P	—	P	P	—	—	—
3	P	P	P	—	—	—	—	—
4	P	—	—	—	—	—	—	—
5	P	P	—	—	—	—	—	—
6	P	P	—	—	—	—	—	—
7	—	P	—	—	—	—	—	—
8	—	P	—	—	—	P	—	—
9	P	P	—	—	—	—	—	—
10	P	P	P	—	—	—	—	—
11	P	P	P	—	—	—	—	P
12	P	P	—	P	P	—	—	—
13	—	P	—	—	—	—	—	—
14	P	P	—	—	P	—	—	—
15	P	P	—	—	—	—	—	P
16	P	P	—	P	—	—	—	P
17	P	P	P	—	—	—	—	P
18	P	P	—	—	—	—	—	P
19	P	P	P	—	—	—	—	—
20	P	P	—	—	—	—	—	—
21	P	P	P	P	P	—	—	—
22	P	P	—	—	—	—	—	P
23	P	P	—	—	—	—	—	—
24	P	P	—	—	—	—	P	—
25	P	P	P	P	P	—	—	—
26	—	P	—	P	—	—	—	—
Total	22	25	7	6	5	1	1	6

Records frequently added to, indicate that *Enchytræid* worms can be direct and primary plant enemies, and in the case of one of my clover specimens I found the *Enchytræids* in the tissue of the root; the larvæ of *Camptocampus aterrimus* are found in decaying vegetable matter, but I have been told

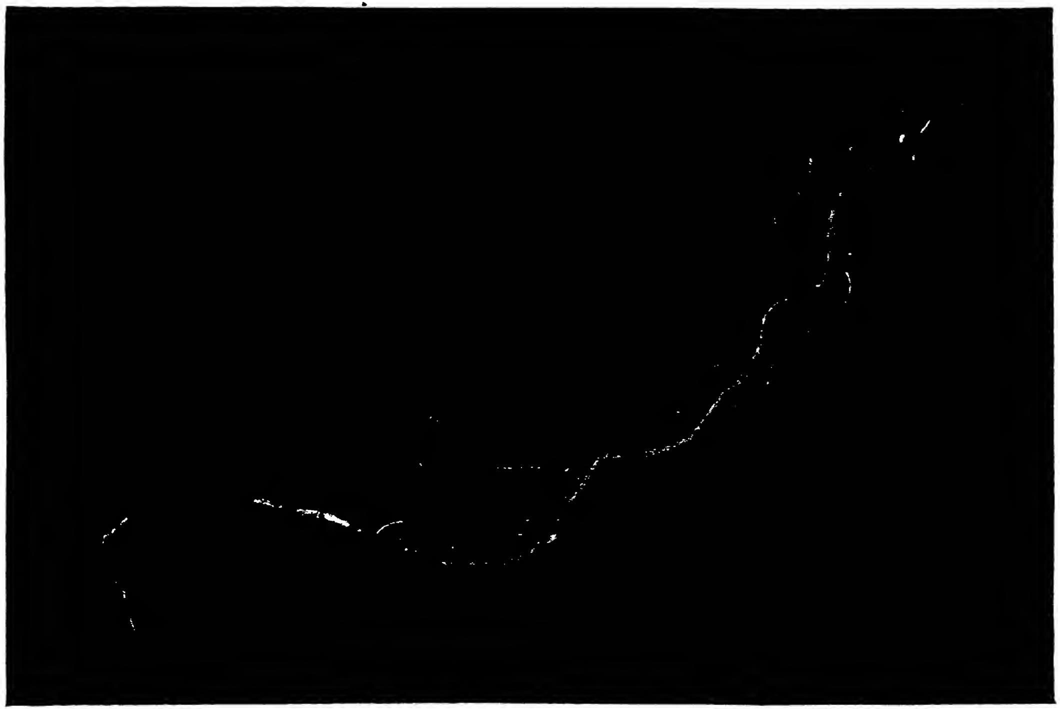

FIG 2
Red Clover plant showing larvæ of *Amblyspatha ormerodi* at apex (from nature).

of their direct damage to the rhenoids of Hepaticæ; all the recorded animals or fungi present may be neglected as regards this inquiry except the fungus *Sclerotinia*, the eelworm *Tylenchus*, and the *Cecidomyid*. *Sclerotinia* is a proved and dangerous enemy of red clover, and with *Tylenchus* is a well-known cause of Clover Sickness.* It may here be mentioned that a number of the typically spoiled clover plants came from fields where there had been no previous complaints of Clover Sickness, and in some cases red clover had not been taken for a number of years.

It will be seen from the foregoing table that eelworms as well as Cecid larvæ were present in most cases, and in a number of cases no lesions could be found that could safely be ascribed to the maggots alone.

Description of Damage Done.—(1) In most cases the young plants were as shown in Fig. 1; the plant was diseased just at the surface of the soil at the junction of the primary root with the stem; this was the characteristic place for the *Tylenchus*, and here also the fly larvæ could be found.

(2) The young side-shoots were often quite decayed; the pith was hollowed out, and had often broken down, remaining only as a powdery mass. The shoots were deformed.

(3) Sometimes in the young stems only the vascular bundles were left.

(4) The stipules of the unexpanded leaves were often dead and blackened, and the young leaflets themselves discoloured.

(5) The primary root in small plants was sometimes spoiled, but in larger, stronger plants the primary root had practically escaped damage or the damage was limited to its apex.

Where the Gall-midge Maggots were Found.—(1) In the tap or primary root (Fig. 5). In one case where the tap root was a strong one, two live *Cecidomyid* larvæ were found almost two inches down into the root.

(2) At the apex of the plant at the ground level (Fig. 2). From the rotten apex of one little plant I took nearly thirty *Cecidomyid* larvæ and only three eelworms.

(3) In some of the withered and browned side-shoots six to eight larvæ were found.

(4) In unopened leaflets marked by black patches.

* See *Journal*, February, 1913, p. 928.

(5) In unexpanded buds.

(6) Large numbers of the larvæ were in the soil for pupation. Some pupæ were also found in the soil.

The Various Species of Clover Cecidomyids.—With our new species there are in Britain three different *Cecidomyid* enemies of clover. The maggots of the new species are very small, but nevertheless are visible to the naked eye. They are red, orange-red, or whitish pink in colour, and can be distinguished in the field without difficulty from the other clover midge larvæ if an ordinary hand-lens be used. They can be distinguished partly by their position in the plant and especially by the shape of the "anchor process" or "sternal spatula," a dark-coloured horny structure on the under-surface at the head end (Fig. 3 and Fig. 6). The anchor processes of the maggots of the three species are shown in Fig. 4.

Determination of the adult *Cecidomyids* can scarcely be undertaken in the field, not only because the insects are so small, frail, and delicate, but because the microscope may be necessary.

Amblyspatha ormerodi probably lays its eggs on the unopened buds or on the young leaves—in confinement eggs have been laid on the young leaves of clover plants available to the females—and the larvæ are found in the places indicated above. Red Clover is the plant attacked, though further observation may show other host plants.

The Clover Leaf Midge, *Dasyneura* (*Cecidomyia*) *trifolii* lays its eggs in the leaves of White Clover (*Trifolium repens*) before the leaflets have expanded. The maggots live under cover of the leaflets, which never open out, but become swollen and brown. The leaves chosen for egg-laying are low down on the plant. This species has been known to lay its eggs also on red clover, but it is not a serious clover enemy.

A more serious enemy than the last is the Clover Seed-Midge, *Dasyneura* (*Cecidomyia*) *leguminicola*,* females of which lay their eggs in the unopened flower heads of red clover. There the eggs hatch, and the result of the maggot infestation is that flowers do not open and no seed is produced.

* A very excellent account of *D. trifolii* and *D. leguminicola* is given by Mr. J. W. Folsom in the Twenty-fifth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois (1909).

FIG 3
Larva of *Amblyspatha ormerodi* Greatly magnified (from nature)

2 1 3

FIG 4.

1 = anchor process of *Amblyspatha ormerodi* (from nature)
2 = ,, ,, ,, *Dasyneura leguminicola*
3 = ,, ,, ,, *Dasyneura trifolii*.

2 and 3 after Folsom in Twenty-fifth Report of the State Entomologist of Illinois.

White clover may sometimes be infested, and, as Folsom has proved, Alsike clover also.

The Present Infestation by A. ormerodi and Tylenchus devastatrix.—The symptoms and appearance of the clover plants were often such as one is familiar with in eelworm attack, but from the large numbers of the *Cecidomyid* larvæ, and the position of many of them, *A. ormerodi* can scarcely be regarded as other than a direct and distinct enemy of red clover. Professor Kieffer has informed me that the larva of our new species comes very near one that had been once sent to him from Italy as found at the neck of the root of Sainfoin, where it was feeding at the expense of fungi which had invaded the Sainfoin roots. On two occasions at least I found a clump of *A. ormerodi* maggots in a swollen fungus mass, but compared with the large amount of my material this was exceptional.

Doubtless this infestation on clover has been greatly favoured by the comparative mildness and openness of the winter, and there is considerable truth in the observation of a Hereford correspondent, who wrote: "The disease generally appears when there is an abundant autumn growth in the plants after the corn is cut." In the great majority of cases the clover had, as is usual, been sown with barley; in some cases with oats; and in one case with wheat.

'After the cereal crop had been cut last autumn there was (owing to the wet weather) a very marked growth of Red Clover.

It is worthy of note as a possible preventive measure that it was observed that there was no disease on the part of the field that had been fed off closely by sheep, while the plants on the other part were badly attacked. After the harvesting of the cereal crop, when the conditions are such as to lead to a strong growth of clover, and therefore to offer suitable plants on which the midges can lay their eggs, it would be wise to have this clover cut or eaten off by sheep.

Badly infested plants should be ploughed in deeply. The larvæ are found in the soil round the plants for the purpose of pupation, and ploughing them under deeply would make it impossible for the delicate larvæ and pupæ to reach the surface again. Plants that look poor in winter may

recover. Red clover is a hardy plant and can withstand considerable attack. All the plants that were sent to me other than those actually used up in dissection were placed in favourable conditions to test whether they would grow. I was also anxious to spare plants so that I might obtain the adult flies. The plants kept were put in seed-pans or large flower-pots, and enclosed in fine muslin covers. They were watered by plunging the pots, and were kept under glass at a day temperature (on dull days) of 50° F. and a night temperature of 40° F. Under such conditions—admittedly more favourable than they would have received in the fields—the majority of the plants made some recovery. Only a few plants, however, are really robust plants with leaves of normal size; in most the new shoots are puny and the leaves small.

The Board's Leaflet No. 46 (*Stem Eelworm*) should also be read in this connection.

Improvement of the Poultry Industry in Ireland.

IRELAND affords many advantages as a country for the production of poultry; the holdings are small, the climate and soil are generally suitable, and the markets of Great Britain are all within easy reach. Nevertheless, until recent years the poultry industry in Ireland was in anything but a flourishing condition, nor was it difficult to trace some of the causes which checked expansion. Indiscriminate in-breeding, the practice of keeping birds beyond the age of economic productiveness, the absence of facilities for obtaining fresh blood, indifferent methods of housing, feeding, and general management, as well as unsatisfactory methods of marketing, placed the industry under serious disadvantages.

About twenty years ago the Congested Districts Board made an effort to improve the stock in certain areas by introducing and distributing cockerels, but this scheme was subsequently abandoned in favour of the establishment of egg-distributing stations. Selected persons were provided with a limited flock of pure-bred birds, from which they distributed eggs for sitting to cottagers and farmers in the neighbourhood, taking in exchange an equal number of the eggs of

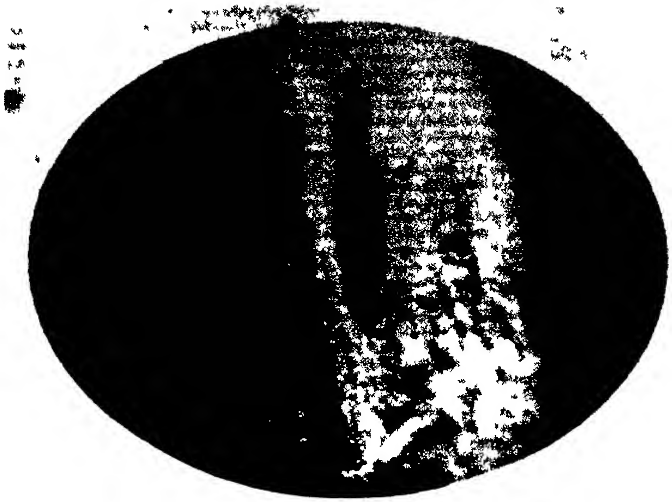

FIG. 5.
Larva of *Amblyspatha ormerodi* in dissected root of Red Clover. Magnified (from nature).

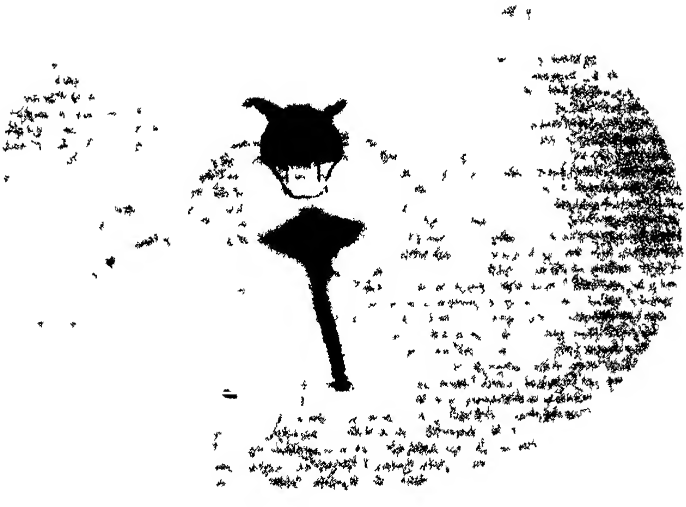

FIG. 6.
Head end of larva of *Amblyspatha ormerodi*. Magnified (from nature).

those who applied for sittings and receiving in addition a subsidy of 1d. for every egg distributed.*

In 1900 the Department of Agriculture and Technical Instruction undertook the work of improving the methods of poultry production throughout the country, and after reviewing the conditions existing at that time the Department decided that organisation and education were essential if adequate and lasting improvement was to be effected.

Fowls.—A scheme was formulated which (1) provided for instruction in the principles and practice of economic poultry-keeping, and (2) provided a means of supplying cottagers and small farmers in all parts of the country with facilities for improving their stock.

In order to attain the first of these objects a body of suitable teachers was necessary, for the success of such instruction must depend on the personality and qualifications of the teacher. Not only was there at that time serious difficulty in obtaining qualified teachers in Ireland, but the means of providing suitable training for those who had personal qualifications and practical experience were also lacking. By instituting short courses of instruction and selecting the most promising candidates for further training in England this difficulty was partly overcome, while, subsequently, in the Munster Institute, at Cork, a suitable centre with adequate accommodation and equipment was provided in Ireland for the training of girls in poultry-keeping, butter-making, and rural domestic economy, and from this centre in recent years the great bulk of the teachers have been drawn.

In order to utilise the services of these teachers so as to benefit all classes of the agricultural community, a scheme was presented for adoption by the agricultural committees of the various counties.

This scheme provided that a county should be divided into convenient circuits, in each of which the teacher should work for a period of about four weeks and deliver a course of four lectures in the evening at each of five centres in the circuit, while during the day-time visits should be paid to cottages and farms in the neighbourhood.

* The History of the Development of Instruction in connection with the Poultry Industry in Ireland. *Jour. Dept. Agric. and Tech. Instr. for Ireland*, October, 1912.

The scheme was accepted by only a few counties at first, but as suitable teachers became available it was put into operation throughout the length and breadth of the country, so that there was, in a comparatively short time, a regularly organised educational system operating throughout Ireland for the improvement of the practice of poultry-keeping. This early "pioneer" work was of very considerable value; the lectures aroused criticism and interest, and they formed an agency through which the instructress was brought into contact with producers, and more especially small producers. Lectures opened the way for visits, and these visits were the means of effecting definite improvement in the practice of poultry-keeping among farmers and cottagers.

This work was a necessary preliminary to more systematic instruction, and after a period of about five years tutorial classes took the place of lectures in this scheme. These classes were attended by girls and women, who received two hours' instruction daily during a period of a fortnight or three weeks. Here theoretical instruction occupied but a small portion of the student's time. Notes were taken on the subject under consideration, and then practical demonstrations were given in connection with such matters as the selection and preparation of food, the killing, plucking, and trussing of poultry, the packing of eggs, the study of the internal structure of the fowl, the appearance of the internal organs in health and disease, and the cultivation of resource and handiness in adapting available material for use in providing efficient home-made appliances. But the instruction was not confined to demonstration; so far as was possible, the students actually carried out all the operations themselves, the class became a *practical* class, and a growth of interest and enthusiasm in the work was the result. Simple, but adequate equipment was provided, and might include illustrations of the different breeds of poultry, models of poultry-houses and coops, a simple arrangement for testing eggs, boxes for packing eggs and poultry, trussing boards, knives and needles, an incubator and simple rearer, and samples of meals and grain.

Side by side with this instructional work, provision was made in the scheme for improving the stock of poultry in the country. The County Committees of Agriculture allocated a

sum of money for the purpose of providing premiums in connection with the establishment of egg-distributing stations. Applications were invited from persons who were willing to maintain such stations, and applicants were selected with a view to securing an even geographical distribution of the stations. Each selected applicant was required to procure thirty hens and three cocks of an approved pure breed, to house them suitably, and to provide them with an adequate run. Save under exceptional circumstances, no other fowls were permitted to remain on the holding. From this pen of pure-bred birds the selected persons were required to distribute 80 sittings of eggs at a price fixed by the County Committee, usually 1*s*. per sitting, to stamp the eggs so issued, to replace infertile eggs when returned, and to record the name of the person to whom the eggs were supplied. The period fixed for the distribution of eggs extended from December 1st to May 31st. When the Committee and the Department were satisfied that the conditions of the scheme had been fulfilled, the station-holder received a premium of £5. It was within the discretion of the County Committee to allocate a limited sum of money to assist newly-selected station-holders to procure suitable birds and *portable* houses.

Ducks.—Provision was also made for the distribution of sittings of eggs from approved breeds of ducks, and a pen of these birds might take the place of some of the hens at the egg-distributing station.

Geese.—A similar scheme provided for the distribution of sittings of Embden goose eggs, but in this case the number of birds kept was small, the premium was £2, and stations were only located in areas suitable for the raising of geese.

Turkeys.—In order to improve the breed of turkeys, premiums of £2 were offered to selected applicants who were willing to purchase and maintain suitable pure-bred American bronze cocks. These birds were available at a fixed fee for the service of a limited number of hens.

A careful system of supervision and inspection, both of the conduct of the teaching and of the egg-distributing stations in the counties, was carried out by the Department.

This outline of the means which have been adopted to improve poultry production in Ireland will indicate the chief

features of the work, but efforts have not been confined to the provision of a cut-and-dried county scheme. There has been no tendency to regard the original scheme as final; in fact, suggestions for alterations and improvements are invited each year from each County Committee of Agriculture. There is a constant endeavour to improve and extend its usefulness, and experimental schemes are initiated by the Department with a view to further this object. Much has been done independently to encourage the production of finished table birds and to train those who were desirous of taking up this branch of work. The practice of using trap nests for ascertaining the actual egg yield of pure-bred and cross-bred birds kept under ordinary conditions has been assisted and encouraged, and a number of breeders in Ireland are now keeping reliable records.* Attention is paid to the requirements of the English market, and it is generally admitted that as a result of effort in this direction a great improvement has taken place in the marketing of Irish poultry produce. Co-operative principles have been applied to the collection and marketing of eggs in some districts with success, and while the tangible results in this direction are not comparable with those obtained in regard to the manufacture of creamery butter, there has been a large amount of pioneer work done which has led the small producer to realise the possibilities of development in this direction.

Poultry production in Ireland is primarily a woman's industry, and its regeneration has been effected in no small degree through the agency of women; during the past twelve years the educational work has been carried out almost exclusively by women teachers. The success of this systematic attempt to improve the conditions of poultry-keeping in Ireland may be gauged to some extent by a consideration of the increase in exports. During the period from 1904 to 1910 the *average yearly increase* in the value of the eggs, poultry, and feathers exported from Ireland amounted to £720,000.

* *Jour. Dept. Agric. and Tech. Instr. for Ireland* April, 1913, p 554 *et seq.*

Report on Small Holdings in 1912.*

UP to the 31st December last, 154,977 acres had been actually acquired or agreed to be acquired for small holdings by County Councils in England and Wales, of which 104,533 acres had been purchased for £3,385,262, and 50,444 acres leased for rents amounting to £63,528. Of this land 124,709 acres had been actually let to 8,950 individual small holders and 212 acres sold to 20 small holders. In addition 6,094 acres had been let to 49 Co-operative Small Holdings Associations, who had sublet the land to 967 of their members, and 2,984 applicants had been provided with over 37,000 acres by private landowners direct, mainly through the instrumentality of the Councils. The land that has been acquired, but which is not yet let in small holdings, will probably provide for another 2,000 applicants, and the Councils of County Boroughs have acquired 1,586 acres which are let to 192 individual small holders and 63 members of Co-operative Associations. It appears therefore that the Small Holdings Act has resulted in the provision of land for approximately 15,176 applicants in five years.

The Board have made inquiries whether the rents for the small holdings established under the Act have been paid punctually, and with very few exceptions the replies received have been in the affirmative. There has been some delay in payment in Dorset, Hunts, Notts, Oxfordshire, Staffs, East Sussex, and Worcestershire, which is attributed mainly to the exceptional difficulties of the last two seasons. On the whole it may be said that the small holders have come through the ordeal very creditably, and that their record will compare favourably with that of the general body of farmers. In those Counties where the Councils arrange for periodical inspection of the cultivation of the holdings, the reports received are very satisfactory, and they indicate in the great majority of cases that the condition of the land has improved since its conversion into small holdings. During the year 1912, 43 tenants received notice to quit from the Councils, which represents a proportion of unsatisfactory tenants of less than one-half per cent.

* Report of the Land Division of the Board on the administration of the Small Holdings Act in 1912. [Cd. 6770; price, 5*d.*]

Speaking generally, it is impossible to doubt that the Act has proved of signal benefit to the rural population. Some mistakes have been made, and there is room for much improvement in the use that is made of the land provided for small holdings. The profits obtained at present ought to be considerably increased, and there is no reason why this should not be done if proper advantage is taken of the increased facilities for agricultural education which are now available. But in spite of shortcomings in this direction a large number of deserving men have been established on holdings; the stream of migration from the rural districts, both to the large urban centres and to the Colonies, has been checked; the continuous decrease in the number of small holdings in the country has been converted into a small but steady increase; there have been very few failures in spite of the somewhat unfavourable seasons; and many of the tenants are so well satisfied with the terms and conditions of their tenancies that they are anxious to increase the size of their holdings as soon as possible. These are all signs of satisfactory progress, and with the increasing tendency on the part of County Councils and of private landowners to co-operate in assisting the small holdings movement, there is every hope of even greater progress in the future.

SUMMARY OF AGRICULTURAL EXPERIMENTS*

SOILS AND MANURING.

Manuring of Mangolds (*Hereford C.C. Agric. Educ. Sub. Com., Farmer's Bull. No.* 8, 1912)—These experiments were carried out at six centres during 1912 on plots $\frac{1}{16}$ acre in size. The soil at three centres was a medium loam, at two centres a clay loam, and at the remaining centre a sandy loam. The table on p. 237 shows the manures applied in addition to 12 tons of farmyard manure per acre, and the average yields obtained per acre.

The value of top-dressing mangolds with nitrate of soda is shown by a comparison of plots 3, 8 and 9. These three plots all received the complete dressing of artificials, but, in addition, plot 3 received 1 cwt., and plot 8 two separate cwts. of nitrate of soda as top dressings after singling. The 1 cwt. nitrate of soda gave an increased yield of

* A Summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

4 tons 5¼ cwt., and the 2 cwt. nitrate of soda an increase of 5 tons 8 cwt. per acre.

Plot.	Manure.	Yield.		Increase over Plot 1		Value of Increase at 12*s.* per ton.			Cost of Manure.			Profit.		
		Tons	Cwt.	Tons.	Cwt	£	*s.*	*d.*	£	*s*	*d*	£	*s.*	*d.*
1	No artificials	23	0¾	—		—			—			—		
2	1 cwt. Nit Soda.. 1 cwt Sul. Am . 4 cwt. Super. ... ¾ cwt. Sul. Pot..	28	5¼	5	4½	3	2	7	2	7	4	0	15	3
3	As in plot 2 + 3 cwt Salt	31	16½	8	15¾	5	5	0	2	11	1	2	13	11
4	1 cwt Nit. Lime. 1 cwt. Sul Am. . 4 cwt. Super. ¾ cwt. Sul. Pot. 3 cwt. Salt	29	2¼	6	1½	3	12	7	2	10	10	1	1	9
5	1 cwt Nit Soda 1 cwt. Sul. Am 4 cwt Super. 5 cwt Kainit	29	18	6	17¼	4	2	4	2	11	8	1	10	8
6	1 cwt Nit Soda . 1 cwt Sul Am. 6 cwt Basic Slag ¾ cwt. Sul Pot.... 3 cwt. Salt	29	12½	6	11¾	3	18	7	2	11	1	1	7	6
7	1 cwt Nit Soda 3¾ cwt Atmogen . 5 cwt. Kainit	30	8½	7	7¾	4	8	9	2	10	11	1	17	10
8	2 cwt Nit Soda 1 cwt. Sul Am 4 cwt Super ¾ cwt Sul Pot 3 cwt. Salt	32	19	9	18¼	5	18	10	3	3	1	2	15	9
9	1 cwt Sul Am 4 cwt Super ¾ cwt Sul Pot. 3 cwt Salt	27	11	4	10¼	2	14	0	1	19	1	0	15	11

Nitrate of lime (plot 4), at the rate of 1 cwt. per acre, proved to be a useful top-dressing for mangolds, but not so effective as an equal weight of nitrate of soda (plot 3) The average results of the last three years show a difference of 24 cwt. of mangolds per acre in favour of nitrate of soda.

Atmogen is a manure which has recently come on the market. Its guaranteed analysis is 10½ per cent. ammonia and 16 per cent. insoluble phosphates, and the price is £6 17*s.* 6*d.* per ton delivered in Hereford. The manure is a very fine black powder, strongly resembling calcium cyanamide and basic slag in appearance, and the former in smell. It is very dusty to sow. It appeared to hinder the germination somewhat, but after the plants were established they came along very well. By comparing plots 5 and 7 it will be seen to have given slightly better results than sulphate of ammonia and superphosphate.

Superphosphate gave better results than basic slag (plots 3 and 6), and a larger yield was obtained from sulphate of potash and salt than from kainit (plots 3 and 5). The effect of adding 3 cwt. of salt (plots 3 and 2) was to increase the yield by 3 tons 11¼ cwt. per acre.

The Nitrogen Enrichment of Soils (*Trans. Roy. Soc. Canada,* 1912. *Vol. vi., Section III. F. T. Shutt and A. T. Charron*).—In this paper the authors summarise their observations and the results of their work in the field and laboratory in Canada since 1905, on the nitrogen enrichment of soils, as follows :—

(1) That, as regards the cultures of nitrogen-fixing bacteria experimented with, while there were many instances in which they distinctly favoured the growth of the legume, their action on the whole was more or less uncertain. The profitable employment of these preparations seems, therefore, problematical. Their vitality is very quickly impaired by light and heat, and unless made by a reputable firm or institution, and still fresh, satisfactory results can scarcely be looked for.

(2) The employment, as an inoculating material, of the soil from the surface of a field bearing a luxurious crop of the specific legume has given better results than the use of cultures. Where cost of transportation is not prohibitive, inoculation with soil will be found the most reliable for the general farmer. Provided the proper precautions were observed, the authors have never found it to fail on any soil which merely lacked the specific nitrogen-fixing bacteria. Notable instances of successful inoculation by this method have been recorded for alfalfa in the North-Western provinces of Canada.

(3) Failure in many cases has been caused by one or more of the following: deficiency of moisture; unsuitable mechanical condition of the soil due to lack of humus; inadequate drainage, or improper working of the soil; acidity of soil, denoting deficiency of lime.

(4) The systematic analysis of a soil continuously in clover shows a constant increase in its nitrogen content. The work reported was continued for nine years, and at very examination the soil was found to be richer in nitrogen. In spite of losses which must have ensued from bacterial activity and other causes, there had been a constant, though not regular, accumulation of this valuable element. The work points to the high manurial value of the residues from a leguminous crop, and emphasises the importance of a rotation which includes a legume, if soil fertility is to be economically maintained.

FIELD CROPS.

Growth of Sugar Beet (*Jour. Dept. of Agric. and Tech. Inst. for Ireland,* April, 1913).—These experiments in 1912 were designed to test the comparative merits of cultivation on the flat and on the ridge, and to ascertain the effect of a dressing of nitrate of soda on the yield of sugar beet. The experiments were carried out at eleven centres on plots $\frac{1}{10}$ acre in size. At nine centres the manures applied per acre were 1 cwt. sulphate of ammonia, 3 cwt. superphosphate, and 6 cwt. kainit, in addition to 15 tons farmyard manure; at the other two centres no farmyard manure was given, but the dressing of artificials was increased. To one-half of each plot nitrate of soda was applied at the rate of 1½ cwt. per acre in two dressings after the plants were singled. The variety of sugar beet tested was Klein Wanzleben "Z," sown at the rate of about 25 lb. per acre: (*a*) on drills 27 in. wide—the crop being treated in much the same way as mangolds; (*b*) on drills 27 in. wide—the crop being moulded up after hoeing; and (*c*) in rows

18 in. apart on the flat. The plants were singled out to 9 inches apart on all plots.

The yields (factory weight) per acre ranged from 1 ton 2 cwt. to 18 tons 14 cwt. The averages for the eleven centres are shown in the following table (the gross weight shown is the weight after removing the tops and roughly cleaning):—

Plots.	Average Yield of Roots per Acre. Gross Weight.		Average Yield of Roots per Acre. Factory Weight.		Ratio of Factory Weight to Gross Weight.	Average Sugar Content of Roots.	Average Coefficient of Purity Apparent.
	Tons.	Cwt.	Tons.	Cwt.	%	%	
Ordinary Drills :—							
(*a*) Without Nit. Soda	13	17	9	17	71·1	18 2	90·51
(*b*) With Nit. Soda ...	15	5	10	14	70 1	17 9	91 11
Moulded-up Drills :—							
(*a*) Without Nit. Soda	14	2	10	5	72·7	18 4	91 21
(*b*) With Nit. Soda .	15	10	11	6	72·9	18 3	91·73
On the Flat :—							
(*a*) Without Nit Soda	13	17	10	10	82·3	18 3	91·09
(*b*) With Nit Soda .	16	6	12	3	74·5	18 2	90·75

The increased yield and superior sugar content of the roots on the moulded-up drills and on the flat, shown in the above table, would not, it is stated, recoup the grower for the higher cost of cultivation. The application of nitrate of soda increased the yield, decreased the sugar content slightly, and impaired the purity in the case of beets grown on the flat.

The sugar content of the roots was much the same as that obtained by the Department in trials in 1911, but owing to the cold and wet season of 1912 the yield was about 4 tons 6 cwt. per acre less than in 1911.

In some cases plots of mangolds were grown alongside the sugar beet, the average yield of the mangolds being about double that of the beets (factory weight) in both 1911 and 1912.

Forage Crops (*Harper Adams Agric. Coll., Rept. on Field Expts.*, 1912).—Trials with various forage crops were begun or continued by the College during the season 1912.

Lucerne grown for the third year in succession did well. Three cuttings were made during the season. The first on May 14th gave a yield of 12 tons (green) per acre, the second, on August 2nd, also gave 12 tons, while the last, on August 31st, yielded 5 tons (green) per acre. Chinese lucerne, in comparison, gave a very poor yield, amounting in two cuttings to 4 tons 1 cwt. per acre.

Sainfoin was sown for the second time in 1911, and a yield of 5 tons 19 cwt. per acre was obtained in two cuttings.

Wold Grass was in its second year, having been sown in the spring of 1911. It was allowed to seed itself in 1911, and has since completely covered the ground. A strong plant was obtained which stood the winter and produced good strong early growth. It was cut on June 13th, and yielded 10 tons 6 cwt.

Trifolium incarnatum **was sown in September, 1911, and a good**

plant was obtained which stood the winter. Cutting took place on June 17th, when the yield was 14 tons 18 cwt. per acre.

Lathyrus sylvestris, grown for the third year in 1912, yielded 10 tons 15 cwt. of green fodder per acre when cut on July 14th. The foliage and stems were hard and coarse, and stock did not appear to care much for it.

Linseed was sown on April 26th in rows four inches apart at the rate of 104 lb. per acre. A very fair plant was obtained, and throughout the season appeared satisfactory. The crop was pulled by hand, tied in small sheaves, and partially dried in the field. It was further dried under cover, and yielded 520 lb. linseed and 26 cwt. fibre per acre.

Helianthi were put in in 1910, and have been cut each season. The underground stems appeared to have spread throughout the plot. The crop was cut on June 17th, but the hard, coarse foliage and woody stems were such that stock would not touch it.

LIVE STOCK AND FEEDING STUFFS.

Calf Rearing (*R.A S.E. Rept. on the Calf Rearing Expt , conducted at the Woburn Exptl Farm, 1912–13. J. A Voelcker*)—An experiment was begun at the Woburn Farm in the spring of 1912 on the best way of rearing calves from birth.

Twenty bull calves (Shorthorns) were selected and purchased in the open market at the end of March, when they were two to three days old, and were brought on to the farm They all had whole milk *only* for the first three weeks, taking on the average one gallon per head daily. At the end of three weeks they were all weighed, and were divided up, according to their weights, into five lots of four calves each. They were fed for nine weeks on the following foods Lot 1. Cod-liver oil and separated milk. Lot 2 A purchased "calf meal" along with whole milk and separated milk. Lot 3. Gruel consisting of 6 lb. fine oatmeal and 1 lb. linseed to one gallon of water, with separated milk. Lot 4. Whole milk Lot 5. Crushed oats given dry, and separated milk. In the case of lots 1, 3, and 5 the separated milk was substituted gradually for the whole milk of the preliminary three weeks' feeding, the change to separated milk being completed in three further weeks. The results of the nine weeks' feeding are shown in the following table:—

	Food	Cost per Calf per Week		Gain per Calf per Week.	Cost per lb. Gain in Live Weight.
		s.	d	lb	d
Lot 1	Cod Liver Oil . .	2	8·19	9 66	3 33
,, 2	Calf Meal	2	0	8 66	2·77
,, 3	Gruel . . .	2	4·77	8 33	3 45
,, 4	Whole Milk	5	9·22	12·83	5·39
,, 5	Crushed Oats	2	9 61	13·30	2·52

It will be seen that the crushed oats gave the highest gain in live weight, and at the lowest cost per lb. of increase. The whole milk gave the next highest gain, but at a much increased cost.

The calves, as they finished their nine weeks' special feeding, and

when they were all twelve weeks old, were turned out into the yard and all fed alike with separated milk, a little linseed cake, and crushed oats. On July 14th, milk was discontinued, and on July 18th the calves were turned out to run in the fields, being given linseed cake, crushed oats and hay. On September 1st a calf from the crushed oats lot was attacked by anthrax and killed. On September 17th (after 91 days further feeding) the calves were again weighed. On September 23rd all were castrated, and then fed on throughout the winter, being out in the fields in the day-time and coming into the yard at night, where they had linseed cake with a little cotton cake, hay and sliced roots. On February 5th, 1913, having completed twenty weeks since the last time of weighing, they were again weighed, and the results are given in the following table:—

	Food.	Average Gain per Calf Daily from June 18, 1912 to Sept. 17, 1912.	Average Gain per Calf Daily from Sept. 17, 1912 to Feb 5, 1913.	Average Gain per Calf Daily over Whole Period.
		lb.	lb.	lb.
Lot 1	Cod Liver Oil ..	1·90	1·63	1·74
,, 2	Calf Meal . .	1·75	1·53	1·62
,, 3	Gruel .	1·57	2·01	1·84
,, 4	Whole Milk	2·00	1·90	1·94
,, 5	Crushed Oats	2·19	1·90	2·00

It is concluded that the early feeding of calves has an important bearing on their after development, and that a "good start" is very essential. The improvement effected by the early feeding with dry crushed oats was thus maintained for a period of quite seven months after the special feeding had been dropped.

Pig Feeding (*Seale-Hayne Agric. Coll. Rept. on Pig Feeding Expts., March,* 1913).—Experiments have been carried out on the Seale-Hayne College Farm during the last three years to compare the value of various foods for pork and bacon production.

English and Foreign Barleys.—English and Russian barleys of approximately the same price were compared, two lots of six pigs each being used for the experiment. In addition to the same amounts of the particular kind of barley, each lot received the same weight of boiled potatoes. The experiment lasted from November 29th, 1910, to March 19th, 1911, and during this period the increase in carcass weight made by the lot fed with English barley was 319 lb., and that by the lot fed with Russian barley was 380 lb., giving a difference of 61 lb. (or 10 lb. per pig) in favour of Russian barley. The financial results of the experiment showed a profit of £2 5*s*. 9*d*. from English barley, and £3 7*s*. 6*d*. from Russian barley, or an advantage of 3*s*. 7½*d*. per pig in favour of Russian barley.

Soya Bean Cake in Addition to Barley.—Two lots of four pigs each were used in the experiment. They were all fed for a few weeks on barley, middlings being then introduced, and later maize, the barley being discontinued. In one lot part of the barley (and afterwards middlings) was replaced by an equal amount of soya bean cake. It

was found that a much greater profit was realised where no soya bean cake was fed, and that soya bean cake in small quantities did not form a profitable food for bacon production, even at the low price of £6 5s. per ton. It is pointed out that this is in agreement with the results of a large number of experiments carried out in Denmark with different oil cakes, and in which the conclusions reached were that "a pound of oil cake has no more value for pigs than a pound of barley," and that "oil in the food has not the high nutritive value with pigs assigned it by trial with ruminants."

Fish Meal.—The value of fish meal for pig feeding was shown by two series of experiments

In the first series two lots of four pigs each were fed from January 11th to May 6th, 1912, on gram and maize in one case, and gram, maize, and fish meal in the other, it being arranged that the total weight of food consumed in the period by the two lots was the same. There was found to be an increase in carcass weight of 540 lb, where no fish meal was fed, and of 623 lb. where the meal was given. The fish meal cost £14 per ton, and 461 lb in all was fed to the four pigs during the four months. The *increased* profit from the fish meal was found to be £1 13s. 11d. on the four pigs, or nearly 8s. 6d. per pig.

In the second series the two lots of pigs were duplicated, and the fish meal given in about half the quantity used in the first series, *viz.*, 1 lb. of fish meal to 7 lb. of corn. The two lots of pigs fed on fish meal each received 364 lb of the meal, 2,291 lb. of maize, and 280 lb. of other grain from September 20th, 1912, to January 14th, 1913, while the lots receiving no fish meal were each given 2,599 lb. maize and 336 lb. of other grain during the period The increase in carcass weight during the experiment was 1,117 lb. in the case of the eight pigs given fish meal, and 848 lb. in the case of the eight pigs receiving no fish meal, giving a difference of nearly 34 lb per pig in favour of the fish meal over the four months.

The financial results of the experiment showed a profit of £10 2s. 9d. from the lots fed on fish meal, and of £5 4s. 10d. from the lots receiving no fish meal, or an increased profit of 12s. per pig in favour of fish meal. It is pointed out that some pork butchers will not take pigs if they know them to have been fed on fish meal, and that in such case it might be better to feed the fish meal in the early days of the fattening period, and to omit it altogether, say, during the last month.

Linseed Mucilage (*Journ. of Agric. Sci., vol. v., part 2, March,* 1913, *Allen Neville*).—The investigation with which this report deals was carried out in the Department of Agriculture of Cambridge University. After extraction of the mucilage its chemical properties were examined and an account of them is contained in the report. The behaviour of the material when fed to stock in linseed is of considerable importance from a practical point of view, and accordingly the action of the various digestive ferments on it was investigated. It was found that in laboratory experiments the mucilage is unattacked by the digestive enzymes, such as, *e.g.*, Taka and barley diastases, saliva, and pepsin, and when it was fed to a non-ruminant animal 75 per cent. passed through unchanged. Unfortunately, the preparation of mucilage on a sufficiently large scale to form any appreciable portion of a ration

for a ruminant animal, such as a sheep or cow, was impossible with only laboratory apparatus, but from laboratory experiments it seemed probable that the mucilage is attacked by intestinal bacteria, and, in ruminants especially, largely broken up in this way, with the evolution of gases and certain volatile acids among other products.

The author observes that these results draw attention once more to the use of the term, "soluble carbohydrates," in connection with feeding stuffs. In the usual routine analysis of foods many different compounds are grouped under this heading, and are necessarily assigned one feeding value Where the sugars and starches form the great bulk of the substances so grouped no great error results, but where, as in the case of linseed, the principal "soluble carbohydrate" is one of very different behaviour in the animal organism, the ordinary analysis may be misleading Although it was impossible to prepare mucilage in sufficiently large quantities to carry out rigid feeding experiments on large animals, the results which were obtained point to a much lower actual feeding value for linseed mucilage than for starches and sugars. This result is of considerable importance, since popular opinion assigns to linseed such a high value, and even routine analysis necessarily gives it a value equal to the starches and sugars.

Comparison of Crowdy with Dry Concentrated Foods for Dairy Cows (*Durham C.C. Educ. Com., Offerton Bull. No.* 4; *Frank P. Walker, B.Sc.*).—It is a common practice in the district for milk producers to feed their cows with concentrated foods made up in the form of what is known as "crowdy," meals being mixed up with hot or cold water to a thickness varying from a stiff porridge to what is practically a drink. The object of this experiment was to test the idea that the use of crowdy improves the flow and quality of the milk, and to see whether the extra expense compared with dry meals was repaid.

The rations given were as follows, and after the two lots of five cows each had been fed on one kind of ration for a period the rations were reversed so as to minimise the effect of the individuality of the animals :—

LOT I		LOT II	
60 lb. Swedes		60 lb Swedes	
12 lb Meadow Hay		12 lb Meadow Hay	
7 lb Oat Straw		7 lb Oat Straw	
6 lb Soya Bean Cake	Fed as Crowdy	6 lb. Soya Bean Cake	Fed Dry
4 lb Barley Meal		4 lb Barley Meal	
1 lb Maize Meal		1 lb. Maize Meal	
2 gals. Water			

The results show that so far as these experiments give any indications the feeding of meals in the form of crowdy is an altogether unnecessary expense on the part of the dairy farmer. So long as the meals are good of their kind, and the animals are well nourished with a suitable ration and a good water supply, dry meals do as well as crowdy for milk production, and certainly better, so far as live weight increase of the cows is concerned, at the end of the lactation period. The error of individuality of the cows in the two lots was, however, greater than usual, and it is considered very desirable that the experiment should be repeated another season.

Comparison of Sudan Dura with Maize as a Food for Dairy Cows (*Durham C.C. Educ. Com., Offerton Bull. No.* 4; *Frank P. Walker, B.Sc.*).—Dura or Kaffir corn, *Sorghum vulgare*, is widely cultivated in most tropical countries, and supplies have recently come from South Africa and the Anglo-Egyptian Sudan. As transport facilities increase it is expected that there will be a continuous increase in the exports. As a foodstuff it resembles maize, and, as in the case of soya cake, if it is increasingly used by dairy farmers its importation will be extended, and will tend to keep down the prices of the better-known foods. The rations fed in this experiment per cow per day were:—

LOT I	LOT II
6 lb. Soya Cake	6 lb. Soya Cake
4 lb Maize Meal	4 lb. Dura Meal
60 lb Swedes	60 lb Swedes
12 lb. Meadow Hay	12 lb. Meadow Hay
7 lb. Oat Straw	7 lb. Oat Straw

Each lot consisted of five cows, and the rations were changed over after eight weeks, the cows that had been having dura meal then having maize meal for another eight weeks. The results, so far as flow of milk and quality are concerned, were practically identical. So far as increase in live weight was concerned, maize gave better results. It appears that dairy farmers might with advantage use dura as a substitute for maize, especially in case of the former being cheaper per ton.

Comparison of Soya Cake with Decorticated Cotton Cake as a Food for Dairy Cows (*Durham C.C. Education Com., Offerton Bull. No.* 4; *Frank P. Walker, B.Sc.*).—The first experiment extended from January 2nd, 1910, till February 19th, 1910. The cows were divided into two lots of five each, and received the following rations per cow per day respectively :—

LOT I	LOT II
5 lb. Decorticated Cotton Cake	5 lb Soya Cake
3 lb Bombay Cotton Cake	3 lb Bombay Cotton Cake
6 lb. Oat Straw	6 lb. Oat Straw
60 lb. Swedes	60 lb. Swedes
12 lb Old Land Hay	12 lb. Old Land Hay

The amount of milk and its quality were found to be strikingly similar, but the result of the experiment was slightly in favour of soya cake for milk production.

The rations were then changed over, Lot 1 receiving soya cake, and Lot 2 decorticated cotton cake, when results were obtained confirming the first experiment. The following is the summary of the results obtained .—

(*a*) Soya cake and decorticated cotton cake of average qualities are very similar in chemical composition. The latter is slightly richer in oil, while the former is slightly richer in flesh producers.

(*b*) So far as these two cakes are concerned in the feeding of dairy cows, the one can be safely used as a substitute for the other.

(*c*) Soya cake is slightly better than decorticated cotton cake for milch cows.

(*d*) Soya cake, being so highly nitrogenous in character, ought not to be used in larger quantities for dairy cows than about 6 lb. per head daily, and wherever used it should always be mixed with some other

food particularly rich in carbohydrates or heat-producers, as distinct from foods rich in flesh producers.

(*e*) Soya cake is cheaper than decorticated cotton cake, and on this account alone deserves favourable consideration at the hands of dairy farmers.

DAIRYING.

Yield and Quality of Milk of Individual Cows (*Durham C.C. Educ. Com., Offerton Bull. No.* 4; *Douglas A. Gilchrist, M.Sc.*).—Tables are given showing the quantity and quality of milk of 34 cows of the milking shorthorn type at Offerton Hall. Twenty-four were milked three times daily and ten twice daily. Of the former the milk produced at 6 a.m., after a twelve hours' interval, was the poorest, and the greatest in quantity. The richest milk was given at 12 noon, after a six hours' interval, and this was also greater in quantity than that at 6 p.m., also after a six hours' interval.

Factors Influencing the Change in Flavour in Storage Butter (*U.S. Dept. of Agric., Bureau of Animal Industry, Bull.* 162, 1913.—The economic conditions in the United States, which have made it necessary to hold butter in storage for long periods, have increased the importance of the changes that take place in butter on standing, and an attempt was made to determine the part played by certain factors in this connection.

The following conclusions were reached:—

(1) A perfected method of analysis employed gave no evidence of an increase in soluble nitrogen in butter on long standing at 0° F., even when the conditions of the manufacture were most favourable to such changes.

(2) Buttermilk from sweet unpasteurized cream and from sweet pasteurized cream when preserved with 18 per cent. sodium chloride to correspond to butter-curd solution, showed no proteolysis during a long period in cold storage.

(3) Butter made from sweet pasteurized cream kept much better than butter made from similar cream without pasteurization, but the changes in the unpasteurized cream butter could not be reproduced by re-inoculating the pasteurized cream with the bacteria of the cream before pasteurization.

(4) About 10 per cent., by volume, of fresh butter is gas, consisting approximately of nitrogen (by difference) 33 per cent., oxygen 20 per cent., and the remainder of gases absorbable by sodium hydroxide. The oxygen was materially less after storage.

(5) The addition of iron to cream even in as small an amount as one or two parts per million parts of cream, had an influence on the flavour of the butter. There was nothing to show that the nature of the flavour was appreciably changed, but the rate of development was accelerated.

(6) Cream may take up iron in quantities sufficient to affect the flavour from rusty cans, or even from the exposed boltheads or other metal parts of the churn.

(7) The action of copper is similar, but perhaps more intense.

(8) It was found that in milk to which 18 per cent. sodium chloride had been added there was no change in the lactose when iron was added and a current of oxygen passed through the milk for 72 hours.

(9) A strong odour may be produced in milk by the addition of small amounts of iron salts.

POULTRY.

Autumn and Spring Chicken Rearing (*Harper Adams Agric. Coll. Report on Field Expts.*, 1912).—Experiments were conducted in 1910–11–12, in order (1) to determine the cost of rearing autumn-hatched chickens to a killing age; (2) to note the rate of increase in weight week by week for food consumed; (3) to compare the cost of autumn and spring rearing.

Feeding.—In both experiments the feeding was the same. For the first twelve weeks they were fed entirely on dry food, and from twelve weeks old to the time of selling they were given soft food during the day, and whole barley for the evening feed

	Autumn Rearing Experiment. 1910			Spring Rearing Experiment. 1912.		
	£	s	d.	£	s.	d.
Initial Cost of Eggs .	0	5	2	0	8	4
Cost of Oil for Incubator and Brooder .	0	1	1	0	2	0
Cost of Grain and Meal .	1	5	5½	2	10	0
Total ..	1	11	8½	3	0	4
Number of Chickens .	16			50		
Average Cost per Chicken	2*s.* 0*d.*			1*s.* 2*d.*		
Market Value per Chicken	3*s* 0*d.*			2*s.* 6*d*		

The results showed that in a normal season the rate of growth is much more rapid, and less costly in spring than in autumn.

Cost of Producing 1 lb. Weight :—

Autumn, 1910 . . .	6·4 pence
Spring, 1912	4 1 pence

The Utility Poultry Club's Twelve Months' Laying Competition.—The competition has now been running for seven months, and the figures for the seventh period, which ended on April 29th, are available.

The position of the leading pens is as follows :—

Order	Pen No.	Breed.	Total Eggs for Seven Months.	Total Money Value.		
				£	s.	d.
1	86	Buff Rock ..	676	3	17	2¾
2	60	White Wyandotte	711	3	15	11¼
3	32	,, ,, .. .	666	3	8	7¼
4	45	,, ,, ..	638	3	5	9¼
5	24	Black Leghorn	608	3	3	11½
6	40	White Wyandotte .	604	3	3	0¼
7	35	,, ,, . ..	623	3	2	8¾
8	80	Buff Orpington	602	3	2	7¼

The highest score of the month was secured by the Silver-laced Wyandottes in Pen 62, which produced 163 eggs. A slight decrease in the total number of eggs laid during the month—10,684 as against 11,292 laid the previous month—is attributed to broodiness.

NOTES ON AGRICULTURAL CO-OPERATION AND SMALL HOLDINGS.

Whixall Cow Insurance Society.

Whixall is a rural parish in North Shropshire, near Whitchurch. It has a total acreage under crops and grass of under 3,000 acres, of which nearly 2,300 acres are under permanent grass. The chief occupation is dairying, and there are in the parish about 1,500 cattle of all kinds, including 800 cows and heifers in milk or in calf. It contains about 170 holdings above one acre and under 50 acres in area. The land is valuable and rents generally at from £2 10*s*. to £3 per acre, while some used for market-gardening pays as much as £4 or £5.

In 1842 the cow-owners of Whixall and the neighbourhood formed a Cow Insurance Club, which in 1857 was registered under the Friendly Societies Act by the name of "The Cow Club held at Whixall." It is now the largest registered Cow Insurance Society in England and Wales, and at the end of last year consisted of 298 members and insured 1,395 cows and calves. The members are almost all small holders, and many of them own their own holdings. They must be residents of the parish of Whixall or of neighbouring parishes, but some of them live as much as seven miles away from the headquarters of the Society.

A member pays 1*s*. per cow as entrance fee, and 1*s*. per quarter, that is at the rate of 4*s*. per year, as premium for each cow; for a calf he pays 6*d*. entrance fee and 9*d*. per quarter as premium. The Society pays the value of each animal which dies from disease or accident while under insurance, subject to a maximum of £10 for a cow and £5 for a calf. No member is allowed to insure more than eight cows and six calves.

On the average of the last eleven years the Society insured 1,310 cows and calves annually; of these 27 died, which gives the very low average death-rate of 2·1 per cent. per annum. On these animals the Society paid £219, an average of £8 2*s*. per animal that died and of 3*s*. 4*d*. per animal insured. The average amount received in premiums was £246 per annum, an average of 3*s*. 9*d*. per animal insured. The amount received in premiums was thus in itself more than sufficient to cover the losses; but besides this there was an average income of £29 from interest and of £9 for the sale of carcasses and hides, and the total income of the insurance fund averaged £289, while the total expenditure charged against that fund was only £219, thus showing an average annual surplus of £70. At the beginning of the period the insurance fund amounted to £1,217, and had not the Society distributed a dividend of £561 among its members, the fund would now have amounted to £1,900. Even after distribution of that dividend, it again amounted to £1,340 at the end of last year. This sum represented the accumulated savings of past years, and is the unencumbered property of the Society. With the exception of a small amount retained in order to pay insurance claims without delay, it is deposited in the Savings Bank and brings in an income to the Society in interest of £29 a year.

The expenses of management are met from a separate fund, towards which the members contribute 2*d*. a year for every cow or calf insured. This contribution averages £10 a year, while the total expenses of management average £20, the difference being made up from entrance fees and other miscellaneous income. The cost of management was therefore kept at the very low figure of less than 4*d*. per animal insured.

The affairs of the Society are managed by three trustees, a treasurer, a secretary, and a committee consisting of six persons, elected annually by the members in general meeting. The present trustees are two farmers and a blacksmith. The committee consists of farmers and small holders. The secretary is Mr. Buckley, a retired small farmer, who has held the post for thirty-one years and to whose devotion to the interests of the Society its success is largely due. He receives a salary of £10 a year. The three trustees are paid £1 10*s*. a year, and the two auditors, who are a schoolmaster and a boot-dealer, receive £1 a year for their services. The only other salaries paid by the Society are 3*s*. given to the stewards on each cow and 1*s*. 6*d*. on each calf that dies while insured. There are three stewards, carefully selected for their trustworthiness and their knowledge of cows. Each of them has a separate district assigned to him, and when a cow or calf is offered for insurance he has to examine it, pass it as sound, and mark it as accepted for insurance. When an insured animal falls ill or meets with an accident, the steward is called in to value it and see that it is properly treated. The Society pays only on animals that actually die. The steward, when he is satisfied that the animal was an insured animal and that its death was not due to carelessness on the owner's part, gives the owner a sealed note containing his valuation, which the owner then takes to the secretary. The secretary gives him a cheque for the amount, and after obtaining the signature of one of the trustees, the owner can at once draw the amount to which he is entitled. Much importance is attached to prompt payment, which enables the member to make good his loss without delay. The Society has an excellent system of account-keeping, under which its reserve fund is deposited in the Savings Bank and cannot be drawn upon except under the signature of all three trustees, while the funds required to meet immediate demands are kept in a current account in an ordinary bank in the names of the trustees, and can only be drawn upon under the signature of the secretary and one of the trustees. There are seldom any disputes about valuations or other matters, and if any do arise they are settled by the committee, who are all men of weight and experience.

Thus this Society has for seventy years insured its members against loss of their cows and calves from disease or accident, paying their full value up to £10 per cow and £5 per calf, at the very low average charge of 4*s*. altogether per animal insured, and has at the same time built up a reserve fund of £1,340, which not only brings in a considerable income in interest, but secures the members from the risk of having to make a special contribution to meet exceptional losses. It now amounts to £1 per animal insured, and would be enough in itself to meet four times the highest loss yet experienced by the Society in any one year. This wonderful success is due not only to the care taken by the office-bearers of the Society in conducting its

affairs, but also to the extraordinarily low death-rate of 2·1 per cent. per annum (as compared with 2·4 per cent., the average for Cow Clubs in England and Wales), which proves that the members generally pay great attention to the health of their cows and calves. In the worst year of the last ten the death-rate was only 2·8 per cent., and in the best year it was only 1·6.

With its large reserve fund and the secure position this confers, the Society could well afford either to increase the benefits it offers to members or to reduce the contributions required from them. Unfortunately, one of its rules says:—"If at any time the funds of this Society, after all claims existing upon it have been met, shall exceed one thousand pounds, in twelve months afterwards a division shall be made to each member (not honorary) in proportion of the time of his paying thereto, of all and every sum that may exceed one thousand pounds, at the time such division takes place, but not to reduce the funds less than one thousand pounds." In accordance with this rule, in 1908 the Society, finding that its funds then amounted to over £1,500, divided among its members £561. The books showed how much each member had paid in premiums during the previous thirty-four years, and for every £1 so paid by each member he was given a dividend of 3*s*. This was a fair method of distribution and satisfied everybody, but it was contrary to true co-operative principles to distribute in this way a portion of the reserve fund which had been laboriously built up in the previous years of the Society's working. The Society might now, like the neighbouring Prees Cottagers' Cow Club, take advantage of its large reserve to reduce the premium payable per cow from 4*s*. to 3*s*. per annum for all members of over ten years' standing, so long as the balance at the credit of the insurance fund does not fall below £1,000.

A Successful Small Holding of Seven Acres.*

Cases of successful small holdings are described in the Report mentioned in the footnote. In one instance the small holder is the tenant of a house, buildings and 7 acres of land in all, the greater part of which is rented from the local authority. The holding is not a compact holding; it comprises seven separate plots of land scattered about the neighbourhood, the most distant plot being two miles from the homestead. The reason is that the tenant has acquired allotments from time to time, and owing to the improvements he has made he has not been desirous of giving them up to take a compact holding. Several years ago, the tenant, then an agricultural labourer working for 2*s*. 3*d*. a day, first hired an allotment of half an acre. It is not proposed to follow up the development from the acquisition of this allotment as an adjunct to the ordinary work of a farm labourer, to the possession of a holding of seven acres on which the tenant is now fully employed, but it may be stated that he and his wife have brought up a family of nine children, and that he has had no help of any kind nor any advantage, other than that of living in a parish in which the local authority has

* Report on the Administration of the Small Holdings Act in 1912. [Cd. 6770; price, 5*d*.]

always been willing to provide allotments and small holdings for suitable applicants.

The land of the district is a loam, varying in texture from a light, free-working soil, to a stronger soil on clay, suitable for standard fruit trees. The land tenanted was bare on entry, and some of it was in poor condition. The seven acres are cultivated now as follows:—

2	acres	under	Fruit.
2	,,	,,	Bulbs.
1	,,	,,	Wheat.
1	,,	,,	Oats.
½	,,	,,	Clover.
½	,,	Homestead.	
Total 7	acres.		

The Home holding (in the village) covers about half an acre of land This is occupied by various buildings, a flower garden, stack-yard, poultry run, and a vegetable garden in which several fruit trees are planted. The house is a roomy old cottage. All the outbuildings were erected by the tenant at his own cost They are timber-built and are roofed with glass, wood, or corrugated iron. They comprise a lean-to building at the south side of the cottage wall, used as a forcing house, a room for packing flowers, a stable, piggery, cart-shed, and a large implement shed in which hampers, chips, and sprouting boxes for potatoes are stored when not in use.

The tenant pays a rent, inclusive of rates, of ten guineas a year for the Home holding, 5 guineas an acre and rates for the land planted with fruit trees, and 50s. an acre and rates for the bare land which he himself has planted with fruit trees or bulbs. The total rent exclusive of rates paid for the seven acres and the cottage is £31 15*s*. 6*d*. a year.

One horse—a strong cob—is kept. This horse is able to plough and work the land, take the trolley to the railway station or the light cart to the market When ploughing the stronger loam, the task accomplished is half an acre a day. Hired team labour is required, as a rule, only when the wheat and oats are drilled. The whole of the bulb land and part of the land under fruit is under spade cultivation

The tenant and his married son are fully occupied in cultivating the seven acres. An extra man is employed occasionally. Other members of the tenant's family assist at busy times, especially at the fruit-picking and bloom-gathering seasons.

The tenant keeps pigs; but, having no grass land, a cow is not kept. If a paddock were available, it would be very convenient for the horse in summer, for a cow, and for the poultry, which would pick up more insect food and be healthier than in the confined poultry run. In the circumstances, half an acre of arable land is reserved for clover, cut green for horse food in the summer and partly made into hay for winter supply. The oats are grown for horse corn, while the oat straw is cut into chaff. The oats not required are sold. The wheat is sold, the straw being carefully husbanded and used for

bedding the horse and pigs and for covering potatoes kept through the winter.

Sufficient yard manure is made for the arable land. For special vegetable crops, artificial manure is used in addition to the yard manure.

The tenant sells fat pigs but retains sufficient for home consumption. Eggs are also sold. Formerly home-grown wheat was kept for domestic use, but the practice of grinding wheat at the village mill has ceased. Hence the flour for home-baked bread is bought. Substituting for the flour, home-grown wheat of a corresponding value, it will be seen that the tenant is able to produce on his holding practically all his requirements for home consumption, viz., bread, bacon, poultry, eggs, potatoes, fruit and green vegetables, together with jams, pickles, and bottled fruits. This is probably equivalent to half the cost of living. If a cow were kept butter and milk could be added to the list.

The tenant grows for market the following fruits:—Strawberries, black currants, gooseberries, raspberries (dwarf canes), plums (Victoria), eating apples and cooking apples, chiefly the Bramley Seedling variety which grows satisfactorily in the district. Hitherto, his soft fruit bushes have not been attacked with mite or mildew.

The bush fruit trees and the standard trees are planted in the same row, the rows being 15 to 18 ft. apart. Crops of green peas, onions, broad beans, or early potatoes are cultivated between the rows of trees which are as yet only partly grown. When the early potatoes have been lifted, there is time for a crop of white turnips or cabbages. These can be marketed sufficiently early for the land to be used again in the following spring for potatoes. The potato sets for both the early and the main crops are sprouted in boxes before being planted. The green peas, ripening at two stages, are either sold locally or sent away by rail.

The bulbs comprise about 25 varieties of the Narcissus group and several kinds of tulips. Beginning twelve years ago with a small stock in the garden, the tenant has gradually accumulated a stock sufficient to plant fully two acres of land. Purchases of bulbs have been made from time to time, and the stock may now be worth from £400 to £500. No bulbs have been sold hitherto. The varieties have been so selected that the tenant can keep up, in a normal season, a continuous supply of bloom for about ten weeks, commencing at the end of January with Ornatus flowers from the forcing-house, and finishing with Double Whites, the last of the Narcissi blooming in the open. Boxes of bloom despatched from the railway station at 7.30 p.m. reach the London markets in time for the earliest morning sales, and the Liverpool, Manchester, and Yorkshire markets sufficiently early for sales next morning.

The tenant experienced considerable difficulty in the early days in selling his produce, and suffered losses through consigning goods to salesmen in response to circulars received. On one occasion, £1 only was received for two tons of potatoes, worth 90*s.* at home, and on another a quantity of plums realised 1*s.* per stone, the market price being 2*s.* 6*d.* per stone. In due course, however, he was able to find reliable salesmen in the towns named, and, having established

connections, he has found it best to send with as much regularity as possible to the same salesmen.

The long distance from the principal markets has been somewhat of a handicap, and the railway rates on the comparatively small consignments have been proportionately heavier. On the other hand, the tenant has no doubt that by packing his goods himself and by closely supervising the work done on his holding, his produce is marketed in better condition than is possible where large consignments must be handled and despatched within a limited time.

The returns vary greatly, and the present season (1912) has been unsatisfactory, especially in regard to field peas and onions. Taking one season with another, however, the remunerative prices realised have led the tenant to appreciate the importance of aiming at producing goods of the best quality and sending them to market in an attractive and saleable form. To this cause mainly, he attributes his success in making a very comfortable living from so small an acreage, and in being able to afford to pay for assistance, the equivalent of the wages of two adults the year round.

The Development of Agricultural Co-operation in Europe.

The following table, showing for most of the countries of Europe (1) the number of persons engaged in agriculture with the respective percentages of total population; (2) the number of co-operative societies; (3) the number per 10,000 of such persons; and (4) the number of acres of cultivated area per co-operative society, is taken from the Report to the Board of Agriculture and Fisheries on *Agricultural Credit and Agricultural Co-operation in Germany* (Cd. 6626, price 5*s*.), and affords a comparative view of the present position of agricultural co-operation in the most important countries of Europe. A better criterion than the mere numbers of societies per 10,000 persons would be that of their membership, but unfortunately such data of a trustworthy kind are available in only a few cases.

Country.	Number of Persons occupied in Agriculture	Percentage of such Persons to Total "occupied" Population.	Total Number of Societies.	Number of Societies per 10,000 such Persons.	Number of Acres of Cultivated Area per Society.
Great Britain	1,508,767	9·2	520	3	28,375
Ireland	871,989	44·7	970	11	3,378
Austria	8,205,574	60·9	10,515	13	2,531
Belgium	697,372	22·7	3,844	55	943
Bulgaria	1,739,181	82·6	693	4	13,816
Denmark	530,689	48·2	1,220	23	5,287
France	8,843,761	42·7	7,200	8	8,226
Germany	9,883,257	35·2	26,026	26	3,058
Holland	592,774	30·7	1,376	23	1,606
Hungary	6,055,390	69·7	5,006	8	7,110
Italy	9,666,467	59·4	8,630	9	3,964
Russia	18,245,287	58·3	11,192	6	—
Switzerland	481,649	30·9	5,366	111	—

OFFICIAL NOTICES AND CIRCULARS.

Buildings for Small Holdings.

The recently issued Report [Cd. 6708] on Rural Cottages and Buildings for Small Holdings, and the series of plans and specifications appended thereto, have aroused attention all over the country, but it has been strongly represented to Mr. Runciman that the published price of the volume (11*s.* 3*d.*) is so high as to place it beyond the reach of many of those whom it is intended to benefit most. In consequence of the great demand for copies, Mr. Runciman has been able to arrange with His Majesty's Stationery Office, with the sanction of the Publications Committee of the House of Commons, for a large re-issue at the price of 1*s.* 6*d.* per copy (postage 4*d.* extra). The new edition is not abridged in any way, and contains exact reproductions of all the plans and specifications published with the original Report. Copies may be ordered, either directly or through any bookseller, from Messrs. Wyman and Sons, Ltd., Fetter Lane, London, E.C.

Fream Memorial Prize.

The Board of Agriculture and Fisheries have awarded a Fream Memorial Prize of the value of £7 1*s.* 8*d.* to Mr. Thomas Beaton Manson, a student of the West of Scotland Agricultural College, Glasgow, who obtained the highest marks in the recent examination for the National Diploma in Agriculture.

Annual Report of the Intelligence Division, 1911-12.

Part II. of the Annual Report of the Intelligence Division of the Board for 1911–12 has been recently issued [Cd. 6730, price 3*d.*] This Report contains an account of the proceedings of the Board during 1911–12 under the Destructive Insects and Pests Acts, 1877 and 1907, and the Board of Agriculture Act, 1889, and relates to the work of the Intelligence Division in so far as it deals with diseases of plants, insect pests, and the industry of horticulture. The subjects treated more particularly are American Gooseberry Mildew, Wart Disease of Potatoes, the Large Larch Sawfly, and Silver Leaf Disease. Maps showing the amount of American Gooseberry Mildew in various districts, and the intensity of Wart Disease of potatoes, are given in a separate publication [Cd. 6730–1, price 1*s.* 7*d.*].

MISCELLANEOUS NOTES.

Importation Regulations.

Importation of Seed Potatoes into the East Africa Protectorate.—The Board have received through the Colonial Office a copy of the Official Gazette of the East Africa Protectorate for 1st April, 1913, containing a notice to the effect that permission to import seed potatoes from the United Kingdom will be granted, provided that the consignment is accompanied by—

(1) A certificate, under the seal of either of the Boards of Agriculture for England, Scotland or Ireland, to the effect that no case of Wart

Disease has been reported within a radius of five miles from the place where the tubers were grown, and by

(2) A declaration on oath by the consignor that all the potatoes consigned were grown in the place mentioned in the certificate.

Export of Horses to America.—The Government of the United States of America have recently adopted new regulations which require that horses exported from the United Kingdom to America must be accompanied *inter alia* by an official export certificate to the effect that, so far as it has been possible to ascertain, no case of dourine, glanders, farcy, epizootic lymphangitis, or mange, has occurred in the locality or localities where the horses have been located within the preceding twelve months

In order to obtain the official certificate, intending exporters from Great Britain should apply to the Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W., for forms of application, which must be returned duly completed, together with a declaration from the owner or person in charge of each horse, stating that the animal has not been exposed to any disease contagious to horses during the preceding six months, and that during the six weeks immediately preceding shipment, the horse has been continuously located in the district whence moved for exportation.

Exporters of horses from Ireland should apply to the Secretary, Department of Agriculture and Technical Instruction for Ireland (Veterinary Branch), 13 Upper Merrion Street, Dublin.

The official certificate will not be required as regards horses exported before the 1st July.

Importation of Hides into Roumania.—With reference to the notice in this *Journal* for August, 1912, p. 412, a Roumanian Ministerial Decision of the 8th March provides that untanned hides and skins, salted, may be imported into Roumania under the following conditions :—

(*a*) They must be introduced through frontier veterinary stations connected with railways.

(*b*) They must be accompanied by sanitary certificates attesting that the articles come from healthy animals, and proceed from localities free from anthrax, bovine plague, and other epizootic diseases.

(*c*) The sanitary certificates must be accompanied by a translation into the Roumanian or French language, and must be authenticated by a public authority.

(*d*) The official Veterinary Inspector at the frontier will examine the sanitary certificates and ascertain the condition of the hides. If the latter fulfil the conditions laid down, importation will be permitted, but the importer will be required to send the hides immediately and direct, with all necessary precautions, to the manufactory for which they are destined. (*Board of Trade Journal*, May 22nd, 1913.)

Export of Live Stock to Argentina.—The Board have been officially informed that the Argentine Government have revoked the Decree prohibiting the importation into the Argentine Republic of live stock from the United Kingdom. The Board are now prepared to resume the issue of export certificates as required by the Regulations of the Argentine Government in connection with any consignments of animals to be shipped to that country.

Notes on Agriculture Abroad.

State Assistance to the Animal Breeding Industry in France.—The following account of State assistance to animal breeding in France relates only to the aid rendered *directly* to the industry by the State. Indirect aid is given in various ways, *e.g.*, through the veterinary service, the payment of compensation under animal diseases laws, education, and especially through the provision of numerous State itinerant teachers who have to supervise experimental fields in which crops for the production of feeding stuffs are cultivated, as well as to consider the granting of premiums in respect of well-conducted holdings (in which the management of the live-stock would naturally be an important part).

The live-stock industry is aided by the State *directly* in three ways. animal insurance is assisted, premiums are given to exhibitions and shows, and subventions are granted to co-operative animal breeding societies.

Animal Insurance.—A considerable sum is provided annually in the budget of the French Ministry of Agriculture, from which subventions are granted to the funds of co-operative insurance societies which conform to legal requirements This sum increased from £20,000 in 1898 (the year in which it was first made) to £48,000 in 1905, at which figure it stood in 1911, and to £63,000 in 1912. Between 1898 and 1911 £404,000 in all was granted by the Ministry of Agriculture in subsidies to the societies About £1,400 was allocated in 1912 to the expenses of inspection, leaving £61,600 for the actual subventions. It must be explained that subventions are granted from this fund to all co-operative insurance societies, animal insurance societies receiving about two-thirds of the whole.

At the beginning of 1912 there were 8,869 local animal insurance societies, with 473,747 members, and an insured capital of £24,210,000. Of these societies, 3,413 were re-insured with 64 re-insuring societies, and the value of the animals thus re-insured was £6,900,000. Subventions are granted in two ways:—(1) An amount of from £12 to £24 (according to the size of the society) is given to aid the formation of a society; and (2) further grants are made to increase the reserve funds of the societies in years of exceptional losses. There is no standard rate of subsidy in the case of the latter grant Some societies are only able to continue with the aid of this subvention, which is renewed again and again, and many of them have hardly any incentive to carry on their business on profitable lines, while many well-managed clubs receive nothing from the State. In place of the present system the support by the State of re-insurance is advocated. The principle of subsidising only those societies which are re-insured was, however, formerly impracticable, as there was far too little opportunity for re-insuring A project laid before Parliament some two years or more ago to establish a State re-insuring institute of the third degree was not very favourably received, as the general consensus of opinion was that the State should confine itself to subsidising and controlling and not directly concern itself with the work of live-stock insurance. On the reorganisation of the French Department of Agriculture in 1911, affairs relating to insurance were included in the section for credit and co-operation, and it is now the

aim of the section to extend the principle of re-insurance; and the movement has been further helped by the establishment of a re-insurance institute of the third degree by the *Fédération Nationale de la Mutualité et de la Coopération Agricoles.* A similar institute had been in existence for some years (it was founded by the *Union Centrale des Agriculteurs de France*), but it was hoped that the new institute, with its superior organisation and with State aid, would bring about a more rapid extension of the re-insurance movement. By May 31st, 1912, 20 unions had re-insured with this new institution, their re-insured capital being £2,400,000. As soon as re-insurance becomes fairly general and every society has an opportunity to re-insure, the greater part of the State subventions will be given only to re-insuring societies of the second and third degree, and in proportion to the amount of their premiums.

Shows and Exhibitions.—The sum of £40,000 is annually provided in the budget of the Ministry of Agriculture for subventions to various agricultural societies and unions. Many of these societies hold live-stock shows, at which prizes are given to animals, so that part of this annual sum of £40,000 goes to the support of the live-stock industry; the exact amount, however, cannot be estimated, and in any case these shows are of far less importance than those organised by the Department of Agriculture. The shows held by the local societies are, in fact, regarded as merely complementary to those of the Department of Agriculture, especially in those districts where, for various reasons, no official show is held.

There are three kinds of shows (*concours*) organised by the State:—(1) The annual *Concours général agricole,* for the whole country, held in Paris; (2) the *Concours centraux,* held in several departments; (3) and the *Concours spéciaux de races,* or local shows. The first two categories include also exhibitions of agricultural produce and machinery, and while by far the larger part of the sums allotted is given in premiums to live-stock, a part at least is devoted to premiums to poultry and to awards in respect of dairy, field, and garden produce. The *Concours général agricole* is attended by thousands of agriculturists from all parts of France, and is held in two parts—the first of which, held in February (the agricultural week), is for fat stock, live and dead poultry, dairy produce, fruit, vegetables, wine, &c., while the second, held in June, is for breeding animals and sheepdogs only. The total cost of the *Concours général* borne by the State amounted in 1911 and 1912 to £20,000, of which half was spent in premiums, almost entirely for live-stock.

The sum of £14,500 was provided in the budgets of 1911 and 1912 for the *Concours centraux* and the local shows, this sum being divided almost equally between them. Although all arrangements are made by the Department of Agriculture, the town in which the show is held has to bear the costs of management, so that the State subventions are spent almost entirely in premiums. A local show is devoted every year to practically every French breed of animal. The following figures show the amount of the subventions granted in 1906 and 1911 to these local shows:—

	No. of Shows. 1906.	1911.	Subventions. 1906.	1911.
			£	£
Cattle	19	25	5,200	5,800
Sheep	12	19	1,200	1,440
Swine	3	2	360	320

Subventions to Animal Breeding Societies.—Animal breeding societies in France are as yet relatively unimportant. To encourage the foundation of breeding societies a sum (£8,000) was provided for the first time in the budget of 1912; a society, to obtain a grant, must have as its object the improvement of a certain breed of live-stock by the co-operative purchase and maintenance of male breeding animals, and eventually also of female breeding animals, or by carrying on milk testing. The maintenance of a herd-book is obligatory, and the societies must be established according to the law of 1884 on co-operative societies. (*Mitteilungen der Fachberichterstatter, Austria,* No. 18, 1912, and *Journal Officiel,* France, September 19, 1912.)

State Experimental Farms in New Zealand.—A return issued by the New Zealand Department of Agriculture, Industries, and Commerce gives particulars as to the cost of State experimental farms in New Zealand. Nine experimental farms were at work in 1910–11 and 1911–12, the expenditure being £19,702 in 1910–11, and £20,608 in 1911–12, while the receipts were £10,955 in 1910–11 and £11,181 in 1911–12. The expenditure on six farms between 1892 and 1904 is given, *viz.,* £87,734, and the expenditure on these same six farms between April 1st, 1904, and March 31st, 1912, amounted to £180,659. Two further farms commenced work during the period 1904–12, one in 1906 and the other in 1909, and adding the expenditure on these, the total expenditure on experimental farms in New Zealand between 1892 and 1912 (March 31st), amounted to £275,393.

Demand for Pure Bred Sheep in South Africa.—H.M. Trade Commissioner for South Africa (Sir R. Sothern Holland), reports that, according to a notice in the "Cape Provincial Gazette" of April 25th, Mr. C. H. Mallison, the principal sheep and wool expert to the Union Government, will shortly be visiting the United Kingdom, and will execute commissions for the purchase of pure bred sheep for South African farmers.

Communications on the subject should be addressed to Mr. Mallison, c/o the High Commissioner for South Africa, 72, Victoria Street, London, S.W. (*Board of Trade Journal,* May 22nd, 1913.)

Schools of Agriculture in Argentina.—A decree published in the "Boletin" of April 21st authorises the Argentine Ministry of Agriculture to expend a sum of about £49,000 for the erection of schools of agriculture. (*Board of Trade Journal,* May 22nd, 1913.)

Exhibition of Horses and Donkeys in Paris.—The Board of Agriculture and Fisheries are informed that an exhibition of native breeding horses and donkeys will be held on the Champ de Mars, Paris, from the 18th to the 22nd June, under the direction of the French Ministry of Agriculture.

The Weather in England during May.

District.	Temperature.		Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean.	Diff. from Average.
Week ending May 3rd:	°	°	Inches.	Inches.		Hours	Hours.
England, N.E.	49·8	+3·0	1·25	+0·84	4	4·3	−1·6
England, E. ...	52·4	+4·0	0·96	+0·57	5	5·1	−1·1
Midland Counties .	49·0	+0·7	1·78	+1·36	5	3·0	−2·6
England, S.E	51·0	+1·4	1·01	+0·62	4	4·0	−2·2
England, N.W. ...	48·0	0·0	1·61	+1·10	5	3·4	−2·3
England, S.W. .	48·1	−0·9	1·48	+0·94	6	2·8	−3·5
English Channel	50·4	−0·3	1·01	+0·56	6	4·3	−3·3
Week ending May 10th:							
England, N.E.... ...	47·4	−0·3	1·56	+1·14	5	2·2	−4·1
England, E.	49·2	−0·3	0·62	+0·23	5	2·2	−4·4
Midland Counties ...	47·7	−1·7	1·01	+0·60	6	2·6	−3·5
England, S.E ...	48·9	−1·9	0·79	+0·45	5	3·6	−3·1
England, N.W.	47·7	−1·4	0·95	+0·46	7	3·2	−3·1
England, S.W. ..	48·0	−2·2	1·38	+0·92	6	5·8	−0·9
English Channel .	50·0	−1·8	0·98	+0·63	6	5·7	−2·5
Week ending May 17th:							
England, N.E.	48·1	−0·8	0·03	−0·35	1	6·2	−0·3
England, E. ...	51·8	+0·9	0·03	−0·40	1	8·3	+1·6
Midland Counties	51·0	+0·2	0·23	−0·25	2	6·7	+0·6
England, S.E . ..	53·1	+0·8	0·23	−0·18	2	7·0	+0·2
England, N.W. ...	50·4	−0·1	0·25	−0·25	3	6·3	−0·3
England, S.W. .	53·0	+1·3	0·47	−0·02	3	7·2	+0·3
English Channel ..	52·2	−0·8	0·62	+0·22	4	5·2	−2·9
Week ending May 24th							
England, N.E. .	51·2	+0·5	0·19	−0·21	3	5·5	−1·0
England, E. .. .	53·0	+0·3	0·04	−0·40	1	6·5	−0·4
Midland Counties .	51·7	−0·9	0·12	−0·40	2	5·9	−0·1
England, S.E.... .	53·1	−0·9	0·06	−0·38	2	8·1	+1·2
England, N.W.	50·8	−1·3	0·52	0·00	5	4·4	−2·2
England, S.W.	51·6	−1·5	0·24	−0·26	3	4·7	−2·1
English Channel .	52·6	−1·7	0·07	−0·42	3	5·2	−2·8
Week ending May 31st							
England, N.E.	57·4	+5·0	0·41	−0·02	3	5·9	−0·4
England, E.	63·1	+8·6	0·53	+0·07	2	8·9	+1·9
Midland Counties	60·2	+5·8	0·23	−0·27	2	7·4	+1·2
England, S.E.	61·4	+5·8	0·41	−0·05	2	10·2	+3·1
England, N.W. .	55·9	+2·2	0·21	−0·29	3	6·3	−0·5
England, S.W. .	58·2	+3·5	0·28	−0·20	3	6·9	0·0
English Channel ...	58·3	+2·7	0·14	−0·36	2	8·1	0·0

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for May, 1913, issued by the International Institute of Agriculture, gives the condition of winter cereals on 1st May as follows (100 being taken to represent the prospect of an average crop):—*Wheat.*—Denmark, 93; Spain, 95; Scotland, 100; Luxemburg, 136; Netherlands, 111; Roumania, 120; Switzerland, 94; Canada, 101; United States, 107;

Lower Egypt, 105; Upper Egypt, 116; Tunis, 120. *Rye.*—Denmark, 93; Spain, 95; Luxemburg, 117; Netherlands, 97; Roumania, 120; Switzerland, 87; United States, 102. *Barley.*—Spain, 95; Luxemburg, 102; Netherlands, 109; Roumania, 120; Switzerland, 93; Lower Egypt, 94; Upper Egypt, 117; Tunis, 120. *Oats.*—Spain, 95; Roumania, 120; Switzerland, 97; Tunis, 110. In Germany the condition of the crops on 1st May, expressed according to the system of notation of the country (1=excellent, 2=good, 3=average, 4=bad, 5=very bad), was as follows:—Wheat, 2·5; rye, 2·7. In Austria the condition expressed on the same system was:—Wheat, 2·6; rye, 2·8; barley, 2·2; oats, 2·3.

Sowing of Spring Cereals.—The areas estimated to have been sown with cereals in 1913, expressed as percentages of the corresponding areas sown in 1912, are as follows:—*Wheat.*—Belgium, 50; Spain, 221; Luxemburg, 73; Switzerland, 100. *Rye.*—Spain, 17; Luxemburg, 40; Switzerland, 100. *Barley.*—Belgium, 53; Denmark, 100; Spain, 162; Luxemburg, 117; Switzerland, 100. *Oats.*—Belgium, 112; Denmark, 100; Spain, 299; Luxemburg, 99; Switzerland, 100. The condition of the crops on 1st May was as follows:—*Wheat.*—Spain, 100; Luxemburg, 112; Switzerland, 97. *Rye.*—Spain, 100; Luxemburg, 133; Switzerland, 96. *Barley.*—Denmark, Spain and Scotland, 100; Luxemburg, 122; Switzerland, 96. *Oats.*—Denmark, Spain, and Scotland, 100; Luxemburg, 117; Roumania, 120; Switzerland, 97.

Austria.—The final results of the harvest of 1912 show the production of wheat to have amounted to 8,702,000 qr., an increase of 18 per cent. on the production of 1911. The production of sugar beet is placed at 7,796,000 tons, which is greater than that of 1911 by 86 5 per cent.

Denmark.—The production of sugar beet in 1912 amounted to 970,000 tons, or 35·0 per cent. more than in 1911.

France.—The definite figures of the harvest of 1912 give the production of wheat as 41,670,000 qr. Rye amounted to 6,080,000 qr., barley to 6,049,000 qr., oats to 36,461,000 qr., and maize to 2,752,000 qr. All these crops showed an increase over 1911.

Netherlands.—The production of wheat in 1912, as given in the final figures, amounted to 689,000 qr.

Russia in Europe (63 *governments*).—The final results of the harvest of 1912 place the production of wheat at 77,948,000 qr., rye at 117,915,000 qr., barley at 54,699,000 qr., oats at 99,794,000 qr., and maize at 9,285,000 qr. All these crops, with the exception of maize, were larger than in 1911, wheat by 40 per cent. ***Russia in Asia*** (26 *governments*).—The production of wheat in 1912 amounted to 22,211,000 qr., an increase of over 50 per cent. on 1911.

Australia.—Preliminary figures concerning the wheat harvest of 1912–13 estimate the production to be 10,148,000 qr., which is 13·0 per cent. greater than the production of 1911–12.

s.—The total area under wheat on May 1st was estimated at 16,168,521 acres, under barley at 1,866,283 acres, under oats at 9,876,295 acres, and under rye at 2,945,228 acres. The condition of the crops on the same date was as follows:—Wheat 74 compared with 75 last year, barley 74 compared with 76, oats 73 compared with 75, and rye 74 compared with 75 (100=very good 80=good, 60=fairly good, 50=average, 30=poor, and 20=bad). Wheat was good to very good in

30 of the 87 Departments, fairly good to good in 53, and average to fairly good in 2. (*Journal Officiel* (*France*), *May 22nd.*)

Hungary.—The report of the Ministry of Agriculture on the state of the crops on May 12th states that the dry and warm weather at the end of April and beginning of May was succeeded by heavy rains which fell fairly uniformly over the whole country. After the rains the temperature fell considerably, and the development of the crops was interrupted. This, however, was beneficial as the crops have gained in strength. Autumn crops, especially the early sown, are fairly satisfactory. Spring corn, although in some districts thin and over-run with weeds, is also in fairly good condition.

Rumania.—The German Consul at Galatz reports (on May 9th) that in several parts of the country lack of rain has been succeeded by abundant showers, and the present state of the crops is everywhere very satisfactory. (*Deutscher Reichsanzeiger, May 17th.*)

Russia.—According to returns issued by the Central Statistical Committee of the Ministry of the Interior the condition of autumn and spring sowings on May 14th was very favourable. Winter sowings are only unsatisfactory in one government out of 78. Spring sowings are also unsatisfactory only in one government out of 58. In general the winter sowings are somewhat better than the spring, the latter having been unfavourably affected by the prevailing cold weather to the end of April. (*Broomhall's Corn Trade News,* June 5th.)

Germany.—The production of the crops in 1912, and the difference per cent. in 1912 from the average of the ten years 1902–11 are given as follows:—Winter wheat, 17,945,202 qr., or 13·6 per cent. above; spring wheat, 2,077,330 qr., or 10 per cent. above; barley, 19,185,677 qr., or 14·1 per cent. above; oats, 60,187,447 qr., or 4·86 per cent. above; winter rye, 52,632,048 qr., or 10·7 per cent. above; spring rye, 623,429 qr., or 7·7 per cent. above; potatoes, 49,402,528 tons, or 15 per cent. above; clover hay, 7,821,427 tons, or 5·2 per cent. below; lucerne hay, 1,466,515 tons, or 1·2 per cent above; and hay from permanent grass, 27,236,973 tons, or 10·9 per cent. above. (*Deutscher Reichsanzeiger, May 19th*)

United States.—The Department of Agriculture, reporting on agricultural conditions on June 1st, state that the condition of winter wheat was 83·5, as compared with 74·3 at the same date last year, and 80·7, the average of the past ten years. Preliminary returns give the acreage of spring wheat as 18,663,000 acres, a decrease of 3 per cent. compared with last year, and its condition is given as 93·5, as compared with 95·8 last year. The area under oats is given as 38,341,000 acres, an increase of 1·1 per cent. on last year, and the condition of the crop as 87·0, against 91·1 on June 1st last year. The barley area is returned at 2,755,000 acres, or 3·7 per cent. less than last year, and the condition at 87·1, compared with 91·1 last year. (*Dornbusch,* June 9th, 1913.)

India.—The final forecast gives the yield of wheat for the whole of India as 9,597,000 tons, compared with 9,813,500 tons last year. (*Broomhall,* May 30th.)

Argentina.—During the past week very heavy rains have fallen throughout the whole of the cereal zone, and in many instances these have put a stop to ploughing. The maize harvest has been affected by the wet weather, and a dry spell is now essential. The rains have

also made transport to the stations a serious difficulty, and a heavy falling off in movement will be the result until the roads again become passable. In the south of the province of Buenos Aires and in the Pampa the recent rains have been very beneficial, and pasturage throughout the country could not be in a better condition. (*Review of the River Plate,* May 9th.)

Fruit Crops in Germany.

His Majesty's Consuls in Germany, in reporting on the condition of the fruit crops in that country, state that the prospects for the current season are most unfavourable. Cold weather with frosts and snow which set in about the middle of April did great damage to almost every kind of fruit, and in all quarters severe losses were suffered by what had promised to be an exceptionally plentiful crop. Most harm appears to have been done to the crops in Baden, Wurtemberg, Hesse, and Saxony.

Red, white, and black currants promise small to medium crops, and gooseberries and strawberries a medium crop; most of the raspberry blossom stems were frozen, but it is hoped that fresh shoots may yet make the crop a medium one. Large cherries may be a good crop, but it is feared that the cold days at the beginning of May did further damage; in many districts sweet cherries have been for the most part destroyed, whilst sour cherries are expected to have suffered more than the larger kinds. Peaches and apricots suffered most severely, and a complete failure of these crops is reported. Apples and pears were not much damaged, and good crops are expected. Early Zwetschen plums promise a scanty crop, but a slightly better crop of later kinds is hoped for. Mirabelles are expected to be a good crop on the whole; in the interior of Lorraine they are promising well, but in the left Moselle valley the crops were frozen.

As regards individual districts, the lowlands in Wurtemberg, where the chief fruit-growing districts are to be found, suffered much damage from frosts; but on higher ground trees were more backward and prospects are still fairly good. Apricots, peaches, and early cherries are practically a failure, but later cherries are fair in some places. Plums are a small crop in some districts, but Zwetschen promise an average crop. Early pears and apples are almost a failure, but an average crop of late sorts is expected. Raspberries, red currants, and gooseberries promise fairly well on high land; on low lands they are a failure.

Rhenish Hesse.—Except for apples the fruit crop is almost a total failure. Apricots, peaches, and sweet cherries have been entirely destroyed; plums, mirabelles, and sour cherries have suffered less; about half the average crop of Zwetschen and pears was hoped for, but the setting fruit is now beginning to drop from the trees.

Baden.—Peaches and apricots were frozen, sweet cherries, early Zwetschen, and early plums suffered severely, sour cherries and late Zwetschen were not so much affected. It is hoped that from the abundance of cherry blossom a moderate crop may yet result. A devastating hailstorm was experienced on May 28th, in the neighbourhood of Heidelberg, especially in the Gaiberg district, which is famous for its cherries, and the whole crop has now been ruined.

Unit Prices of Artificial Manures. Statement of cost to the purchaser of 1 per cent. per ton of Nitrogen, Soluble and Insoluble Phosphates, and Potash derived from

	Bristol.	Hull.	King's Lynn.	Liverpool.
	s. d.	s. d.	s. d.	s. d.
Nitrogen from :				
Sulphate of Ammonia 95% pure	13 9	15 8	13 4	13 9
Calcium Cyanamide ...	11 9½	—	12 3	11 9½
Nitrate of Soda pure 95%	16 1½	—	14 7	14 3
Nitrate of Soda pure 90%	—	16 5½	—	15 0
Nitrate of Lime	15 6	—	16 0	14 6
Soluble Phosphates from :				
Superphosphate 35%	1 9½	1 8½	1 7½	1 9
„ 33%	—	—	—	—
„ 30%	—	—	—	—
„ 26%	1 11½	1 10	1 9	1 10
Dissolved Bones ...	2 6	—	—	3 1
Allowed for Insol. Phos.	*1 9*	—	—	*1 4*
Allowed for Nitrogen	*20 0*	—	—	*20 0*
Insoluble Phosphates from :				
Basic Slag	—	—	—	1 4
Bone Meal	1 4½	1 6	1 6	1 3
Allowed for Nitrogen...	*15 2*	*15 8*	*15 9*	*16 3*
Steamed Bone Flour ...	1 4½	1 6½	1 6	1 3
Allowed for Nitrogen...	*15 2*	*15 8*	*15 9*	*16 3*
Potash from :				
Kainit	4 4½	—	3 10	4 2
Sulphate of Potash ...	4 10½	—	4 4	4 6
Muriate of Potash... ...	4 2	—	3 7	4 0
Potash Salts	—	—	—	3 9

NOTE.—These unit prices are based on the probable retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified. They are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the per-

various sources, at certain Ports and Manufacturing Centres, for June, 1913.

London.	Newcastle.	Newport.	Plymouth.	Silloth.	Widnes.
s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
14 6	14 7½	13 9	14 11½	13 9	13 9
12 6	—	11 11½	11 9½	—	—
15 6	15 6½	16 1½	15 6½	14 9	14 3
—	—	—	—	—	15 0
15 9	—	15 6	15 6	—	—
1 9	1 10½	1 10	1 10	1 10½	1 9
—	—	—	1 10	—	—
—	—	—	1 10½	—	—
1 10	2 0½	2 0	2 0	2 2	1 10
2 6	3 4½	4 0	5 2	3 2	3 0
1 9	*1 3½*	*1 4*	*1 3½*	*1 7½*	*1 3*
20 0	*15 6½*	*16 0*	*15 10½*	*15 10½*	*20 0*
1 3	—	1 4	1 3½	—	1 1
1 7	1 3½	1 5	1 7½	1 7½	1 3
16 0	*14 7½*	*15 2*	*15 2½*	*14 7*	*16 3*
1 7	—	1 2½	1 7	1 5	1 3
16 0	—	*15 2*	*15 2½*	*14 7*	*16 3*
4 3	4 0	4 4½	4 4½	4 4½	4 5½
4 9	4 4½	4 9	4 10	4 10	4 6½
4 0	3 6	—	4 2	4 4½	4 0½
—	—	—	—	—	—

centages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, bags, and loss of weight.

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on June 1st, report that the warmth at the end of May was generally of great benefit to all classes of crops, although it would seem that the dry weather has now lasted long enough, and further rain would be desirable.

Agricultural Conditions in England and Wales on June 1st.

Wheat is in most places looking well; the cold weather in the first part of May was by no means beneficial, but much improvement took place at the end of the month. On heavy lands a good deal is thin and still of poor colour.

The area sown with barley is almost the same as last year; there is a very slight increase in acreage in the northern half of the country and a slight decrease in the south. Sowing was generally very late, and a large proportion of the crop, especially in the north, is only just showing above ground. The appearance of the crop is fair, though very variable; and, on heavy lands particularly, a good deal is thin and patchy and sometimes of poor colour. Much the same may be said of oats, of which the area is perhaps a little—1 or 2 per cent.—less than a year ago. The appearance of this crop is, in most places, less satisfactory than barley, the plant being often thin, while a certain amount has been ploughed up and re-sown. Beans and peas are satisfactory, particularly the former.

The area under potatoes will probably prove about 1 per cent. less than last year, although a slightly increased acreage is reported in the chief potato-growing districts of Lincolnshire and Lancashire. Planting is very late and not everywhere completed. Where showing, the young crops are very generally healthy and quite satisfactory, but this can only be said of early varieties, as in most districts very little of the main crop is yet above ground.

Mangold sowing, like other spring operations, is very backward, and in most districts some still remained to be done. Comparatively little is, consequently, showing above ground; and while some reports are to the effect that the young crop is satisfactory, these are not the majority; the plant is often thin, especially that sown late and on heavier soils, which have been generally baked, so that the plant is patchy. Turnip sowing is naturally still later, many districts having hardly begun; and even the preparation of the seed-bed has been rendered impossible on heavy lands, which are caked and too hard to work. Rain is generally required both for the growth of the roots and the preparation of the land.

Hops are growing freely since the warm weather set in at the end of the month, although at the date of the reports they were still mostly backward. Blight is generally making its appearance, and washing has begun. The area under this crop is somewhat larger than last year, by perhaps 3 to 4 per cent., the increase being mostly in Kent.

The fruit crops show considerable variation. Strawberries are very generally a large crop, as are raspberries and currants. Gooseberries are more variable, and good and bad reports concerning them about balance. Apples, with a few exceptions, promise a large crop, but

and cherries are not more than average, and pears seem below average, especially in the south-east.

With very few exceptions, all kinds of hay promise to be unusually large crops, especially seeds-hay. The latter will probably yield quite 10 to 15 per cent. or more above the average, while meadow hay should also be nearly 10 per cent. above the mean. Pastures are also full of grass, and stock have generally thriven well during the month.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on June 1st, 1913, certain diseases of animals existed in the countries specified :—

Austria (for the period May 14th—21st).
Anthrax, Blackleg, Foot-and-Mouth Disease (total of 63 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period April 16th—30th).
Anthrax, Blackleg, Foot-and-Mouth Disease (11 outbreaks in 11 communes), Glanders and Farcy, Rabies.

Bulgaria (for the period April 27th—May 7th).
Rabies.

Denmark (month of April).
Anthrax, Foot-and-Mouth Disease (1 outbreak), Foot-rot, Glanders and Farcy, Swine Erysipelas.

France (for the period May 4th—10th).
Anthrax, Blackleg, Foot-and-Mouth Disease (174 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period May 1st—15th).
Foot-and-Mouth Disease (6 infected places in 5 parishes), Glanders and Farcy, Swine Fever.

Holland (month of April).
Anthrax, Foot-and-Mouth Disease (6 outbreaks in 3 provinces), Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (for the period May 1st—7th).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 14 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period May 5th—11th).
Anthrax, Blackleg, Foot-and-Mouth Disease (1,231 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period March 1st—15th).
Nil.

Norway (month of April).
Anthrax, Blackleg.

Rumania (for the period May 5th—13th).
Anthrax, Dourine, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Russia (month of December).

Anthrax, Foot-and-Mouth Disease (3,702 animals in 55 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (no further returns received).

Spain (month of March).

Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (480 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of April).

Anthrax, Blackleg.

Switzerland (for the period May 12th—18th).

Anthrax, Blackleg, Foot-and-Mouth Disease (104 "étables" entailing 1,097 animals, of which 33 "étables" were declared infected during the period), Swine Fever.

Agricultural Labour in England during May.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in May.

Labourers not on the farm staff lost a little time through wet weather in the first part of the month in many districts, but cases of serious interruption to outdoor work from the weather were exceptional in the reports. In most districts the demand for extra labourers was generally fairly good, farmers in many cases having arrears of work to clear off. The demand principally arose from such work as hoeing and weeding, planting potatoes, carting manure, preparing the land for, and sowing, root crops, while threshing also provided a certain amount of work in some districts.

The supply of extra men was on the whole hardly equal to requirements, and some scarcity of men was reported in a number of districts.

A scarcity of men for permanent situations was also reported from many districts. A rise in wages was fairly general at the Whitsuntide hiring fairs in Cumberland and Westmorland, the increases in some cases amount to £3 or £4 for the half-year as compared with the corresponding hirings in 1912. Increased wages were also reported at hiring fairs in Yorkshire and Lincolnshire.

Fruit Crops in Holland.

H.M. Consul at Rotterdam, giving (from official sources) the condition of fruit on May 21st, states that on the whole the prospects for the coming crop of cherries, currants, gooseberries, and raspberries are very promising. Cherries are reported as good or very good in all districts, with the exception of a few places in North Brabant and in the south of Limburg, where, owing to the bad weather while blossoming, the crop is a failure. Almost everywhere a good or very good crop of red and white currants is expected, although frosts have done some damage in the Betuwe, in Zealand and Utrecht. Black currants are also very favourably reported on. The condition of gooseberries is slightly less favourable, but satisfactory in most districts. Raspberries are very satisfactory everywhere, with the exception of the Westland, where conditions are moderate.

THE CORN MARKETS IN MAY.

C. KAINS-JACKSON.

Wheat.—At the end of the month English wheat was making an average price of 34*s.* 11*d.* at Mark Lane, of 33*s.* 9*d.* at Chelmsford, and of 33*s.* 11*d.* at Ipswich. The average value exceeded 33*s.* at Birmingham, Cambridge, Canterbury, and Norwich. The month's trade lacked any special feature so far as home-grown wheat was concerned, but fair quality marked most of the deliveries, and the grain came to market in a dry and fit condition, with very few exceptions. Value was fully maintained, and sales were over the average for May. While, for English wheat, May was thus a month of stable markets and moderate trade, the business in imported wheat at the ports, including London, Edinburgh, and Manchester, was unsettled and apprehensive. The interest of the month has not attached to all sorts of imported wheat. Australian and Indian have maintained old prices, but wheat from Canada, the United States, and Russia has declined, the New World produce showing a fall of 2*s.*, and Russian of from 1*s.* to 1*s.* 6*d.* The month closed with American Red Winter at 36*s.* 6*d.*, No. 2 Canadian at 38*s.* 6*d.*, No. 3 Canadian at 37*s.* 6*d.*, South Russian at 37*s.* for good and 35*s.* 6*d.* for average. Good Argentine was held for 38*s.* 6*d.* per qr. These were London prices. At Liverpool, per cental, the prices ruling were 8*s.* 1*d.* for Australian, 8*s.* for Chilian, 7*s.* 11*d.* for Californian, 7*s.* 10*d.* for Indian White, 7*s.* 9*d.* for Indian Red, 7*s.* 8*d.* for Argentine, 7*s.* 7*d.* for No. 2 Canadian, 7*s.* 5*d.* for No. 3 Canadian, and 7*s.* 3*d.* for No. 4 Canadian. Neither in London nor Liverpool were there any offers of No. 1 Canadian, but at Liverpool some specially fine wheat from Chicago was obtainable at 7*s.* 8*d.*, and some No. 1 from Duluth at 7*s.* 7*d.* per cental. The shipments of wheat from all ports did not work out at all so heavily as the depressed state of the ports might have led one to expect. Attention appeared to be concentrated on North American, which rose from 1,288,000 qr. in April to just on 2,000,000 qr., and on Russian, which rose from 571,000 qr. to 1,521,000 qr. The Indian shipments at the end of the month were heavy, but the new crop could not be said to have been hurried forward. Argentine shipments were smaller than usual, and those from South Eastern Europe were not important. Australian shipments, 628,000 qr., against 647,000 qr. in April, and 600,000 qr. in May, 1912, may be counted as nearly an average. The supply on passage, 3,700,000 qr., is about the same as a year ago, but it is made up differently. Nothing at all is coming to us from South-Eastern Europe, and our expectations from South America are about 40 per cent. less than they were in 1912. Of Russia's exports the Continent is taking an overwhelming proportion. The increased expectations are of Canadian (all but first quality), of American, and of Indian.

Flour.—Imports of flour for the completed nine months of the cereal year have been quite moderate, and at a rate not exceeding 4,800,000 sacks per annum. Canada and the United States were regarded last

September as likely to profit by their large yields of spring wheat, and to ship largely and steadily the spring wheat flour for which British markets have always had a peculiar liking. If receipts of imported flour to the end of May had been over four million sacks instead of about 3,600,000, no surprise could have been felt. The April rise in prices was lost during the past month, and values at the close were about as follows: Fine Whites, 31*s.* to 31*s.* 6*d.* cash; Best Canadian and American, 29*s.* to 30*s.*; good Household, 28*s.* to 28*s.* 6*d.*; Country Patents, 26*s.* to 27*s.*; Iron Duke, 25*s.* to 25*s.* 3*d.*; American First Bakers', 24*s.* 9*d.* to 25*s.*, and Country Common Whites, 24*s.* to 24*s.* 6*d.* All these prices are per 280 lb. sack. The by-products of the mill are now very cheap. They range from four guineas per ton for common Bran to seven guineas for fine Middlings. North American shipments for May were 518,000 sacks, and on the last day of the month there were 210,000 sacks on passage.

Barley.—Very little English barley has been sold during May, and London has seen scarcely any malting or brewing samples change hands. The country markets have quoted averages with about an eight shillings range—from 23*s.* to 31*s.* per quarter, but these returns will not now be of much importance again until new crop deliveries begin to come in. Imported barley has fallen materially on the month, which closed with Russian, American, and Indian feeding sorts all offered at six shillings per cental. Sound Californian brewing can be had at 36*s.* per 448 lb. The shipments of the month were 248,000 qr. from North America, 1,392,000 qr. from Russia, and 125,000 qr. from South-Eastern Europe. India has as yet shipped hardly any of her new crop, but is said to have a fair quantity to dispose of. There are 300,000 qr. of barley on passage, 115,000 qr. of which is Californian.

Oats.—Some of the country markets have returned excellent averages—23*s.* to 24*s.* per qr. There have, however, been others at which the 1912 crop has already become almost exhausted. Imports have been heavy, and the hot weather towards the end of the month induced port holders to press gain on sale at low prices. Argentine is quoted at 17*s.*, Russian at 18*s.*, and No. 2 Western Canadian at 20*s.* per qr. Shipments for May were 249,000 qr. from North America, 853,000 qr. from South America, and 401,000 qr. from Russia. There were on the 31st 448,000 qr. on passage, chiefly from Buenos Aires and Bahia Blanca.

Maize.—The large new crop in Argentina being an accomplished fact, old stores have been cleared out, and the earlier produce of the hotter provinces has begun to be shipped. Argentina in May shipped 2,207,000 qr., and dominated the trade. North America sent off 403,000 qr., Russia 204,000 qr., and South-Eastern Europe 237,000 qr. There were, on the 31st, 900,000 qr. on passage, principally, of course, from Argentina. The summer-like weather has been all against sales of a fattening food like maize, and prices closed well in buyers' favour The new Argentine maize is of finer quality than usual, and fetched 25*s.* 3*d.* against 24*s.* 3*d.* realised for old. American came at 5*s.* 1*d.* per cental, and round corn at 26*s.* per qr.

Oilseeds.—The large trade done in linseed has been a feature of the month. Mark Lane from January 1st to May 31st is reckoned to have "placed" 290,000 qr. against 138,000 in 1912, and Hull sales are thought to have been 330,000 qr., against 130,000 qr. Despite the heavy

imports there are 540,000 qr. on passage, against 200,000 qr. a year ago. The prices ruling are, Indian, 44*s.* to 45*s.* per 410 lb.; Argentine, 42*s.* to 43*s.* per 416 lb.; and Canadian, 44*s.* to 45*s.* per 424 lb. Indian is 24*s.* and Argentine 20*s.* cheaper on the year. In 1912 Canadian was scarcely offered. The May shipments were 80,000 qr. from Canada, 60,000 qr. from the United States, 239,000 qr. from India, and 966,000 qr. from Argentina. Rapeseed has declined 1*s.* per qr. on the month; about 50*s.* cash is obtainable off stands for Ferozepore. The tendency of the market to favour buyers is sufficiently accounted for by there being 17,000 qr. on passage, against 7,000 qr. a year ago. Cottonseed made 8*s.* 9*d.* to 9*s.* per cwt. for Egyptian in London, but the chief event of the month has been the forward business in new crop for November shipment at eight guineas per ton. The present supply on passage is 27,000 tons, against 20,000 tons a year ago.

Various.—Beet sugar has been on sale at from ten shillings per cwt., and even under, so that a large trade has been done. The staple is seldom fed direct, but its cheapness materially affects the price of a number of proprietary fattening meals and preparations greatly relied upon by farmers. So, too, the cheapness of molasses has a strong influence on the values of articles used in stock fattening. The month has seen a small but steady business in English Winter Beans at 31*s.* to 33*s.* new, and 41*s.* to 43*s.* old. Peas have fallen in value for blue, but have been quietly steady for maple, dun, and partridge. The end of the war in the Near East is expected to make canary seed cheaper, but on the 30th, at Mark Lane, such high prices per quarter (464 lb.) as 95*s.* for Turkish, 100*s.* for Mazagan, and 110*s.* for fine Spanish were still ruling.

THE LIVE AND DEAD MEAT TRADE IN MAY.

A. T. MATTHEWS.

Fat Cattle.—The supplies at most of the larger markets are now somewhat above those of last year at the corresponding date, but at that time fat cattle were getting scarce, and during the last twenty weeks supplies in English markets have averaged about 2,500 weekly fewer than the average of the three previous years. Taking this fact into consideration, and also the very small quantity of fresh-killed beef now entering our ports, it is only to be expected that prices of British cattle should remain extremely firm, and the following average rates for the various breeds during May, show, on the whole, a slight further advance:—Shorthorns, 9*s.* 5d. and 8*s.* 7*d.* for first and second quality respectively, against 9*s.* 3*d.* and 8*s.* 6*d.* in April; Herefords, 9*s.* 8*d.* and 8*s.* 10*d.*, against 9*s.* 8*d.* and 9*s.* 1*d.*; Devons, 9*s.* 5*d.* and 8*s.* 6*d.*, against 9*s.* 3*d.* and 8*s.* 4*d.*; and Polled Scots, 9*s.* 6*d.* and 9*s.*, against 9*s.* 5*d.* and 9*s.* 1*d.* per 14 lb. stone.

There have been fair supplies of Irish bullocks on offer with moderately good finish, and, generally, the condition of cattle coming to market has been well maintained, the supply of stall-fed animals holding out well.

A feature of the month has been the very considerable inequality of prices in different parts of England, as there has frequently been a difference of 11*d.* per stone for prime Shorthorns between the highest and lowest markets, the southern being, as a rule, by far the dearest. Evidently this is due to local and temporary causes, as the relative position is often reversed. Gloucester has been an excellent market during May, while Newcastle, often the highest in England, has, this month, been one of the lowest.

Veal Calves.—Fat calves have been amply supplied, and average prices have receded about ½*d.* per lb. compared with those of April. The May averages were 9½*d.* and 8½*d.* for first and second quality, or a penny per lb. above last year's values.

Fat Sheep.—Supplies of sheep to English markets have improved, and those for the week ending May 21st considerably exceeded the three years' average, but for the 20 weeks ending at that date there was an average weekly shortage of about 6,400. The condition of the sheep offered at Islington has left little to be desired, presenting a striking contrast to the state of things in the spring of 1912. Prices in May, however, have been very similar per stone to those ruling in the same month last year, but the weight of the sheep has been very much greater, and therefore the price per head has been many shillings higher. During the first half of the month the value of sheep in the wool was quite as high as in April, but the following averages refer solely to shorn sheep:—Downs averaged 9*d.*, 8*d.* and 7*d.* for the three qualities; Longwools 8½*d.*, 7½*d.*, and 6¼*d.*; Cheviots of first quality 9¾*d.*, and Cross-breds 9*d.* per lb. These prices were about ½*d.* per lb. better than those obtained for shorn sheep in April.

Fat Lambs.—There have been large supplies of fat lambs, and, although the demand has been good at most markets, prices have steadily declined during the month, and average fully 1*d.* per lb. lower than in April. The average in about thirty-four English markets was 11¼d. and 10½*d.* for first and second quality. As usual, some of the country markets have been much higher than London.

Fat Pigs.—There has been little or no diminution in the demand for bacon pigs, and prices have been very steady and even. In twenty-four English markets during May small weights averaged 8*s.* 5*d.* and 7*s.* 11*d.* per 14 lb. stone for first and second quality.

Carcass Beef—British.—As the season advances the dead-meat trade becomes uncertain, and depends greatly on the weather. At the London Central Market the heat of the last week quite disorganised the trade, and prices declined. Short sides of Scotch fairly maintained April values with an average of 4*s.* 8*d.* for first, and 4*s.* 6*d.* for second quality per 8 lb. stone. Long sides made 4*s.* 6*d.* and 4*s.* 5*d.*, a decline of ¼*d.* per lb. English sides averaged 4*s.* 6*d.* and 4*s.* 5*d.* A very small quantity of Irish beef was offered during the month.

Canadian Beef.—There were again a few sides of Canadian from Deptford occasionally on offer, the best making from 4*s.* 3*d.* to 4*s.* 5*d.* per 8 lb.

Chilled Beef.—The trade in chilled beef has been very irregular, and prices have fluctuated rather severely. In the first week there was a sudden fall of 10*d.* per 8 lb. stone, from which there was only a partial recovery. Hind quarters averaged 3*s.* per stone for best and 2*s.* 8*d.*

for second quality, and fore quarters, 2*s*. 1*d*. and 1*s*. 9*d*. The average for the former was 7*d*. less than that of April.

Frozen Beef.—During May it was sometimes impossible to quote "hard" beef, as when chilled was selling very low, holders declined to expose frozen for sale at all. Best New Zealand hind quarters made 2*s*. 6*d*. and 2*s*. 7*d*. when business was done, and fore quarters 2*s*. 1*d*. and 2*s*. 2*d*.

Carcass Mutton—Fresh-Killed.—The trade in home-killed mutton has been very quiet throughout the month, and prices have been very low at Smithfield in proportion to those for live sheep. Scotch carcasses weighing about 48 lb. have sold uniformly at 8*d*. per lb, and those rather heavier at 7½*d*. English tegs have made an average of 4*s*. 11*d*. and 4*s*. 7*d*. per stone for first and second quality.

Frozen Mutton.—Australian mutton has only been dealt in to a small extent. New Zealand and Argentine was quietly steady, the former selling at 2*s*. 6*d*. to 3*s*., and the latter at 2*s*. 4*d*. to 2*s*. 8*d*. per 8 lb.

Lamb—Fresh Killed.—English lamb has been a sluggish trade in the London market, and prices dropped heavily during the month. Beginning at 6*s*. 8*d*. to 7*s*. 4*d*., it declined steadily till in the last week it was only worth 5*s*. 8*d*. to 6*s*. per stone, the average being 6*s*. 8*d*. and 6*s*. 3*d*. for first and second quality, against 7*s*. 4*d*. and 6*s*. 8*d*. in April. Some Yorkshire Longwool lambs were offered at 4*s*. per stone during the hot weather of the last week.

Frozen Lamb.—New Zealand lamb has been in steady request, and was very dear at first, making 4*s*. 10*d*. per stone, but afterwards it declined somewhat. The average for the month was 4*s*. 8*d*. and 4*s*. 3*d*., with Australian about ½*d*. per lb. cheaper.

Veal.—Prime British veal has fluctuated between 5*s*. 4*d*. and 6*s*. per stone, the average being 5*s*. 7*d*. and 4*s*. 8*d*. per stone for first and second quality. Dutch made fully as much money.

Pork.—British carcasses were worth 5*s*. 4*d*. and 4*s*. 10*d*. per stone till the last week, but owing to the hot weather prices then declined 6*d*. per stone.

THE PROVISION TRADE IN MAY.

HEDLEY STEVENS.

Bacon.—At the commencement of the month prices were generally advanced, but near the Whitsuntide holidays an easier feeling prevailed, followed later by higher prices, the consumptive demand for bacon having increased as a result of the warmer weather. Danish bacon has been in good demand, and at current prices was reported to be very profitable to the Danish curers. In England and Ireland it is reported to be difficult for the curers to make profits at present prices of pigs. The American markets are dearer on the month, and packers now demand very high prices for shipment during the summer months, in some cases equal to an advance of 20*s*. per hundredweight on hams for June and July shipments as against last year. The consumptive demand in the United States is exceptionally good for all hog products, and with the small stocks on hand, no material reduction in prices can

be expected until the autumn, when heavier receipts of hogs are expected as a result of the high prices which have prevailed for several months, high prices being an incentive to production. Prices at Chicago for the month have ranged from $7.95 to $8.75, against $7.00 to $8.05 last year, and $5.65 to $6.40 two years ago.

The arrivals of bacon from Canada continue very small as, although spot prices are about 8*s*.—10*s*. per cwt. over those current at the same time last year, the Canadian curers hold that they cannot profitably compete on account of the abnormally high prices of Canadian pigs. Russian and Polish bacon is now arriving in larger quantities, and is taken freely by those dealers usually handling Canadian and American long sides. Some shipments from Australia are reported to be on passage to this country.

The English curers continue to complain of the difficulty in obtaining sufficient pigs for their requirements, although they are willing to pay current prices.

Cheese.—The trading for the month has been of an unsatisfactory nature, both in regard to the amount of trade done, and the unprofitable prices realised by dealers holding stocks of Canadian and New Zealand makes purchased some time back. These have shown serious losses, in some cases about one penny per lb. The April and May make in Canada has been below that of last year, and with no accumulation of stocks at shipping points, prices have been forced up to 59*s*.—60*s*. c.i.f., which is about 8*s*.—9*s*. below prices obtained at the same time last year, when, with small available stocks, prices were abnormally high. The arrivals from New Zealand continue large, and the season's make is a record one for that country, but the quality has not been so good as in the previous year. Estimated stocks of New Zealand cheese in London and Bristol at the end of May were 34,000 crates (2 cheese in each), against 3,500 crates last year. Estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol), were 67,000, against 23,000 at the same time last year, and 65,000 two years ago.

There has been a fair trade in both old and new season's English cheese at satisfactory prices, and with the favourable climatic conditions during May, the make should be large.

Butter.—During the month there has been a better demand, and in consequence stocks of Colonial butter have been reduced. Prices have fallen slightly, but not sufficiently to warrant buyers operating beyond their hand-to-mouth requirements.

Arrivals from Siberia continue large and the quality satisfactory. Prices for Danish have fallen, and now realise practically the same figures as best New Zealands.

The new make in Ireland is of good quality.

In both Canada and the United States prices are above an export basis.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in May and April, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	May. First Quality.	May. Second Quality.	April. First Quality.	April. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 6	9 0	9 5	9 1
Herefords	9 8	8 10	9 8	9 1
Shorthorns	9 5	8 7	9 3	8 6
Devons	9 5	8 6	9 3	8 4
Welsh Runts	9 4	—	9 2	8 6
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves ...	9½	8½	9¾	8¾
Sheep:—				
Downs	9	8¼	9½	8¾
Longwools	8½	7¾	8¾	8¼
Cheviots	10	9¼	11	10
Blackfaced	9¾	8¾	10¾	10
Welsh	10¼	9¼	10½	9½
Cross-breds	9	8¼	9½	8¾
	per stone.*	per stone*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs ...	8 5	7 11	8 6	8 0
Porkers	8 10	8 3	8 10	8 4
LEAN STOCK:—	per head	per head	per head	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk	23 9	19 4	22 18	18 19
,, —Calvers...	22 6	18 16	21 18	18 12
Other Breeds—In Milk ..	20 17	17 11	19 11	16 18
,, —Calvers ...	17 5	14 12	16 0	14 15
Calves for Rearing	2 12	2 0	2 9	1 17
Store Cattle:—				
Shorthorns—Yearlings	11 16	10 4	11 9	9 14
,, —Two-year-olds	16 7	14 6	15 15	13 17
,, —Three-year-olds	20 6	17 12	19 3	16 19
Herefords —Two-year-olds	18 14	15 16	18 2	15 8
Devons— ,,	16 7	14 16	16 6	14 10
Welsh Runts— ,,	16 15	14 15	15 12	13 17
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	51 9	45 2	51 5	45 9
Store Pigs:—				
8 to 10 weeks old	26 7	21 3	25 8	20 10
12 to 16 weeks old	37 7	29 11	36 3	29 3

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in May, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Leeds.	Liverpool.	London.	Manchester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—						
English	1st	63 6	63 6	63 0	62 6	63 0
	2nd	59 0	61 0	60 0	61 0	60 0
Cow and Bull	1st	55 6	56 6	57 0	49 6	56 0
	2nd	50 6	52 0	51 6	45 0	51 6
Irish : Port killed	1st	—	62 6	63 0	—	—
	2nd	—	—	60 0	—	—
Argentine Frozen—						
Hind Quarters	1st	36 6	37 6	35 6	35 6	35 6
Fore „	1st	30 6	32 0	29 6	30 6	29 6
Argentine Chilled—						
Hind Quarters	1st	44 6	43 6	42 6	42 0	42 6
Fore „	1st	30 6	30 0	29 6	29 0	29 6
Australian Frozen—						
Hind Quarters	1st	35 0	36 0	32 6	35 0	32 6
Fore „	1st	31 0	31 0	28 6	31 0	28 6
VEAL :—						
British	1st	84 0	75 0	83 0	78 0	80 6
	2nd	77 0	69 6	71 0	65 6	74 6
Foreign	1st	—	—	—	79 6	—
MUTTON :—						
Scotch	1st	—	—	86 6	74 6	85 6
	2nd	—	—	81 0	70 0	81 0
English	1st	73 0	76 0	79 6	69 0	81 0
	2nd	65 6	73 6	74 6	64 0	74 6
Irish : Port killed	1st	—	—	79 6	—	—
	2nd	—	—	74 6	—	—
Argentine Frozen	1st	39 6	39 6	36 6	38 0	36 6
Australian „	1st	37 6	39 6	36 6	36 0	36 6
New Zealand „	1st	42 0	—	—	42 6	—
LAMB :—						
British	1st	98 0	106 0	94 0	93 6	99 0
	2nd	91 6	98 0	85 6	87 6	92 0
New Zealand	1st	65 6	65 0	64 6	65 6	65 6
Australian	1st	58 6	60 0	56 0	58 0	56 0
Argentine	1st	59 6	58 6	56 6	60 6	56 6
PORK :—						
British	1st	74 6	71 0	71 0	73 0	74 6
	2nd	70 0	68 0	65 6	66 6	70 0
Foreign	1st	—	—	—	69 0	—

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913.

Weeks ended (*in* 1913).	Wheat. 1911.	Wheat. 1912.	Wheat. 1913.	Barley. 1911.	Barley. 1912.	Barley. 1913.	Oats. 1911.	Oats. 1912.	Oats. 1913.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 4 ...	30 5	33 2	30 5	23 11	33 3	28 6	17 0	20 7	19 10
„ 11 ...	30 8	33 1	30 3	23 10	33 0	28 4	17 2	20 8	19 2
„ 18 ...	30 11	33 4	30 5	24 4	33 3	28 6	17 4	20 11	19 4
„ 25 ...	30 11	33 7	30 11	24 5	33 1	28 10	17 3	21 1	19 4
Feb. 1 ...	30 9	33 8	31 1	24 5	32 10	28 11	17 5	21 3	20 2
„ 8 ..	30 5	34 0	31 0	24 6	33 2	28 10	17 5	21 4	20 1
„ 15 ...	30 3	34 4	30 9	24 7	32 10	29 1	17 6	21 7	20 2
„ 22 ...	30 2	34 6	30 11	24 9	32 8	28 8	17 7	21 9	20 7
Mar. 1 ...	30 0	34 1	31 0	25 0	32 0	28 6	17 5	21 6	20 4
„ 8 ...	30 1	34 1	31 3	25 0	31 7	28 5	17 5	21 8	20 0
„ 15 ..	30 1	34 0	31 1	24 11	31 2	27 11	17 6	21 8	20 2
„ 22 ...	30 2	34 1	31 1	25 0	31 10	28 6	17 5	21 9	19 11
„ 29 ...	30 3	34 4	31 3	24 11	30 3	27 6	17 5	21 8	19 7
Apl. 5 ...	30 4	34 10	31 4	24 7	30 9	27 0	17 7	21 11	19 2
„ 12 ..	30 3	35 4	31 3	25 2	30 2	27 8	18 3	22 1	19 2
„ 19 ...	30 4	36 7	31 6	25 5	29 11	26 11	17 10	22 4	18 10
„ 26 ...	30 11	37 10	31 8	25 5	30 4	26 7	18 3	22 9	19 3
May 3 ...	31 4	38 1	32 2	25 7	30 2	25 11	18 6	23 1	19 6
„ 10 ...	31 8	37 11	32 6	25 1	31 1	25 9	19 0	23 7	19 6
„ 17 ...	32 6	37 8	32 10	25 4	31 2	25 4	19 2	23 7	19 9
„ 24 ...	32 8	37 2	32 10	25 0	31 1	25 3	19 5	23 7	19 11
„ 31 ...	32 5	36 10	32 7	24 10	30 0	26 1	19 5	23 9	20 1
June 7 ...	32 4	36 11	32 10	25 7	29 11	26 2	19 7	24 0	19 8
„ 14 ...	32 3	37 0		23 11	30 8		19 8	23 10	
„ 21 ...	31 11	37 5		23 9	30 8		19 10	24 0	
„ 28 ..	31 10	37 10		24 5	30 2		19 9	23 11	
July 5 ..	32 1	38 2		25 10	31 7		19 9	23 11	
„ 12 ...	32 3	38 3		25 10	30 2		19 11	24 1	
„ 19 ...	32 5	38 10		24 3	30 9		19 5	24 8	
„ 26 ...	32 5	38 9		23 8	30 9		19 7	23 4	
Aug. 2 .	32 0	38 4		24 4	28 6		18 2	22 2	
„ 9 ...	31 6	39 2		26 9	30 7		18 0	22 4	
„ 16 ..	31 6	38 2		27 8	28 3		17 10	21 8	
„ 23 ..	31 8	35 6		28 10	28 1		18 0	20 10	
„ 30 ...	31 7	34 10		28 4	28 6		18 3	20 8	
Sept. 6 ..	31 10	35 1		28 4	29 9		18 1	21 8	
„ 13 ..	32 0	33 5		29 0	29 0		18 5	20 5	
„ 20 ..	32 4	32 7		29 11	29 6		18 9	19 10	
„ 27 ...	32 6	31 7		30 5	29 9		19 1	19 5	
Oct. 4 ..	32 7	31 8		30 9	29 7		19 5	19 8	
„ 11 ...	32 9	31 10		31 0	30 4		19 10	19 5	
„ 18 ...	32 9	32 2		31 5	30 11		19 11	19 9	
„ 25 ...	33 1	33 1		31 7	31 6		20 6	19 10	
Nov. 1 ...	33 4	33 4		31 10	31 10		20 8	20 1	
„ 8 ...	33 4	33 1		32 7	31 11		20 11	19 11	
„ 15 ...	33 1	32 10		32 10	31 2		21 0	19 9	
„ 22 ...	33 0	32 1		33 5	30 11		20 10	19 11	
„ 29 ..	32 10	31 9		33 10	30 8		20 11	19 8	
Dec. 6 ...	32 9	31 0		34 0	29 11		20 9	19 6	
„ 13 ...	32 11	30 8		33 5	29 2		20 9	19 3	
„ 20 ...	32 9	30 7		33 5	28 11		20 8	19 1	
„ 27 ...	33 0	29 10		33 4	28 6		20 7	19 2	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS BERLIN, and BRESLAU.

—		Wheat. 1912.	Wheat. 1913.	Barley. 1912.	Barley. 1913.	Oats. 1912.	Oats. 1913.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	April	49 7	48 9	30 2	30 1	24 0	24 0
	May	52 8	49 8	30 9	30 1	24 6	24 0
Paris:	April	52 2	50 10	29 5	30 6	25 8	23 9
	May	54 0	51 1	29 9	30 2	25 2	23 0
Belgium:	March	35 3	34 5	30 7	30 2	24 11	22 9
	April	38 0	35 3	31 10	29 11	26 3	22 9
Berlin:	March	45 5	43 1	—	—	27 8	22 8
	April	48 9	44 3	—	—	28 0	22 11
Breslau:	March	40 4	37 4	32 10* / 28 11†	27 1* / 25 8†	25 7	20 9
	April	43 9	38 5	—* / 30 6†	26 8* / 25 3†	26 4	20 10

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of May, 1912 and 1913.

—	Wheat. 1912.	Wheat. 1913.	Barley. 1912.	Barley. 1913	Oats. 1912.	Oats. 1913.
	s. d.	s. d.	s. d.	s. d	s. d.	s. d.
London	38 8	34 3	30 7	25 1	24 3	20 6
Norwich	37 7	33 5	30 2	24 9	23 5	18 9
Peterborough . .	37 0	31 2	31 1	24 4	23 4	17 10
Lincoln...	37 2	31 6	30 0	26 2	23 6	20 3
Doncaster	36 10	31 5	28 7	25 9	23 5	20 3
Salisbury	37 6	32 2	31 10	25 8	23 8	20 2

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in May, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol.		Liverpool.		London.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	15 0	14 0	—	—	12 9	11 6
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery ..	115 0	112 0	111 6	109 0	115 6	113 0
,, Factory	102 6	96 0	100 0	93 0	—	—
Danish	—	—	116 6	113 0	115 6	113 0
French	—	—	—	—	122 6	116 0
Russian	105 6	101 6	101 6	99 0	103 0	99 6
Australian	112 6	105 6	108 0	104 0	110 6	107 0
New Zealand ...	116 0	114 0	113 0	111 0	115 0	113 0
Argentine	109 6	105 6	106 6	104 6	108 0	105 0
CHEESE :—						
British—						
Cheddar	75 0	65 0	74 6	71 0	78 0	72 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	70 0	65 0	71 6	67 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	62 6	59 6	61 6	59 0	64 0	62 0
BACON :—						
Irish	84 0	80 6	85 0	79 6	86 0	83 0
Canadian	77 6	75 0	76 6	73 6	77 6	75 6
HAMS :—						
Cumberland	—	—	—	—	115 0	109 6
Irish . ..	—	—	—	—	113 0	109 0
American (long cut) ...	82 0	77 6	79 0	76 0	83 0	78 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	8 6	6 8	—	—	10 0	8 4
Irish	8 9	8 4	8 10	8 2	9 4	8 4
Danish	—	—	—	—	9 7	8 6
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	117 6	90 0	—	—	101 0	90 0
Up-to-Date	110 0	92 0	101 0	96 0	101 0	92 0
Other late varieties ...	112 6	80 0	—	—	88 6	81 0
HAY :—						
Clover	102 6	90 0	100 0	86 0	123 6	111 0
Meadow	90 0	71 0	—	—	111 0	91 6

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

Disease.	May.		Five Months ended May.	
	1913.	1912.	1913.	1912.
Anthrax:—				
Outbreaks	48	60	282	454
Animals attacked	52	64	303	508
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	15	16	75	73
Animals attacked	26	21	224	153
Parasitic Mange:—				
Outbreaks	264	188	1,500	1,959
Animals attacked	509	388	3,074	4,360
Sheep-Scab:—				
Outbreaks	8	11	120	161
Swine-Fever:—				
Outbreaks	301	381	991	1,487
Swine Slaughtered as diseased or exposed to infection ...	5,172	4,706	14,502	18,731

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

Disease.	May.		Five Months ended May.	
	1913.	1912.	1913.	1912.
Anthrax:—				
Outbreaks	—	1	—	2
Animals attacked	—	1	—	2
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	8	8	87	39
Sheep-Scab:—				
Outbreaks	43	11	288	251
Swine-Fever:—				
Outbreaks	24	34	72	121
Swine Slaughtered as diseased or exposed to infection ...	142	438	430	1,150

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Unter welchen Voraussetzungen ist die Wahrscheinlichkeitsrechnung auf die Versuche in der Land- und Forstwirtschaft anwendbar?, *B. Baule* (Fuhling's Landw. Ztg., 1 Marz, 1913) [37(01).]

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THE MANUFACTURE OF CHEESE FROM "HEATED" MILK.

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IN the ordinary manufacture of the various kinds of British cheese, the temperatures to which the milk and curd are heated in the various stages range usually from 80° to 104° F. Those who have handed down the orthodox method of cheese-making to the present-day makers have held the belief that temperatures much exceeding 104° F. are undesirable, and give unsatisfactory results, and no doubt they held the opinion that the manufacture of cheese from milk heated to 150° F. or above was an impossibility. The term "heated milk," as employed here, may be said to imply milk which has been heated to any temperature between 150° and 210° F.

The pasteurisation or heating of milk to such temperatures is known to destroy to a serious extent the coagulative properties of milk, and to introduce the difficulty of acquiring a satisfactory curdling or coagulation of the milk by rennet, in the initial stage of the cheese-making process. This unsatisfactory coagulation of milk presents a real difficulty to the cheese-maker, and it must be overcome before he can hope to make a cheese with any assurance of success.

When milk is raised to a high temperature, certain physical and chemical changes are produced, and account

for the weakened coagulation referred to, which, by the way, becomes more marked as the temperature is increased.

The heating of milk within certain limits increases its coagulative properties. Coagulation is facilitated in the manufacture of Cheddar cheese by heating the milk to a temperature of about 84° F. before adding rennet. At about 140° F. (60° C.) a skin or scum begins to form when milk is heated in contact with air. This formation of scum is probably due to the separation of caseinogen and salts.

When milk is heated to 160° F. (70° C.) it begins to develop a brownish colour and a distinctly "cooked" taste. The changes in colour and taste are probably due to the burning of the sugar.

When heated to temperatures above 185° F. (85° C.) a scalded flavour and odour are pronounced. The scum mentioned above, being an oxidation product, can be avoided by heating the milk out of contact with the air. At 158° F. (70° C.) a change takes place in the albumin which renders it easy of precipitation. The action of rennet on milk heated to this temperature is not so pronounced as it is in the case of milk heated to a temperature between 80° and 90° F. As we approach the boiling point a deposition of salts such as calcium citrate takes place.

Another change which is perceptible at temperatures approaching the boiling point is the running together or fusion of the fat globules. When milk is heated in copper or tin vessels a deposition of some of the milk solids is generally found on the sides and the bottom of the vessels. When this takes place the coagulative properties of the milk are greatly decreased.

When milk is heated rapidly, and is subsequently cooled rapidly, the changes produced in it occur to a less degree than when the heating and cooling processes occupy some time. This fact was appreciated by cheese-makers in the early experiments in connection with cheese-making from pasteurised milk. It was discovered that the best coagulation results were obtained when the pasteurising and cooling were carried out quickly, and those who were experimenting with milk heated by pasteurising machines were getting better results than those who were dependent upon more primitive

heating appliances aided by the use of substances such as phosphate of lime to replace the lime salts precipitated owing to heating.

The manufacture of cheese from milk which has been heated to a high temperature in a steam-jacketed vat, by passing a strong current of steam through the jacket, is only successful up to a certain point, for the reason that by such heating, the time of exposure to the heat has been considerably lengthened, and the milk has been altered to a greater extent. This was demonstrated by experiments conducted at the British Dairy Institute in 1905. In these experiments a pasteurising machine was not employed for the purpose of heating the milk, it being desirable to illustrate what could be done without recourse to any special appliances beyond those ordinarily used in a cheese-making dairy. The milk was heated in bulk in steam-jacketed cheese vats, and the time occupied in the heating of the milk ranged from 20 to 35 minutes. The cooling of the milk was carried out by running it over a Lawrence cooler.

In this experiment cheeses were made from milk which had been heated to different temperatures varying from 150° to 180° F. (65·5° to 82·2° C.). The results pointed to the fact that the cheeses made from milk pasteurised at temperatures from 150° F. to 165° F. (65·5° to 73·8° C.) were a success, but that the cheeses made from milk pasteurised at 170° F. (76·6° C.) and above were disappointing.

The experimental cheeses were exhibited on the stand in connection with the joint educational exhibit of the University College, Reading, and the British Dairy Institute at the London Dairy Show, 1905. At this exhibition the cheeses referred to were criticised by many leading makers and factors. The criticisms offered upon those made from milk heated to the higher temperatures included the following observations, viz.: that the cheese possessed bitterness, excessive moisture, and a faulty texture. It may be noted that some of the Cheddar cheeses made in this experiment from milk pasteurised to 158° F. (70° C.) were supplied to a leading club in Reading, where they gave every satisfaction to connoisseurs of Cheddar cheese. Experiments conducted later, however, demonstrated that with improved apparatus and

improved processes it is possible to make good Cheddar cheese from milk that has been heated to 200° F. (93·3° C.).

Further experimental work in the manufacture of cheese from heated milk was entered into as a result of a discussion on Clause 3 of the Milk and Dairies Bill, 1909, which took place at a meeting of the Council of the British Dairy Farmers' Association held on September 1st, 1909. In a communication dated September 2nd, 1909, from the Secretary of the Association, it was notified to the British Dairy Institute Committee that the Council of the British Dairy Farmers Association were desirous of experiments being made at once "to see if it is possible to make butter and cheese from milk that has been sterilised." The provisions in Clause 3 of the Bill referred to were directed against the presence of the bacilli of tuberculosis in milk and milk products. The clause directed that milk so infected, whether intended for human consumption or for manufacturing purposes should be "boiled or otherwise sterilised." Such a treatment of milk was regarded by cheese-makers as a very drastic one, foreshadowing the destruction of the cheese-making industry.

When milk is boiled, its cheese-making properties are destroyed to such an extent that the manufacture of cheese from it becomes an impossibility to the cheese-maker of average experience.

The boiling of milk is not necessary to destroy the bacilli of tuberculosis. They can be destroyed effectively at lower temperatures than 210° F. (98·9° C.), which is the maximum temperature to which milk can be heated without recourse to special appliances, and so the cheese-making difficulties incurred need not be rendered so serious.

It is known that the "sterilisation of milk" in its scientific sense implies more than the mere boiling of milk, and it is obvious that the true meaning of the term "sterilisation" was not realised.

Experiments in 1909–10.—In 1909 an attempt was made to manufacture Cheddar cheese from milk which had been heated to 210° F. (98·9° C.). A number of cheeses from milk heated to this temperature were made in October and November, 1909. The heating of the milk was carried out in a cylindrical copper vessel of eight gallons capacity, fitted with

a steam jacket and a tightly fitting lid. The apparatus was also fitted with a pipe, which conducted a current of carbonic acid gas to the bottom of the vessel. The heating was carried out by passing steam through the jacket of the vessel, and while the heating was in progress, a current of carbonic acid gas was passed through the body of the milk. As far as could be arranged, the milk when in a heated state was kept from contact with the air. The cooling of the milk was arranged by passing cold water through the steam jacket.

As had been anticipated, it was most difficult to produce a satisfactory coagulation in this milk even by the aid of the addition of calcium citrate and superphosphate of lime to the milk. In fact it may be said that the curds in all cases were very weak indeed.

Great difficulty was experienced in the endeavour to expel the whey, and the curd appeared to lose its adhesive properties, with the result that the cheese had a tendency to fall to pieces, notwithstanding the application of very heavy pressure in the cheese press.

The properties of the cheese so made were as follows:—

(1) It was very granular in texture.

(2) It contained an excess of moisture.

(3) There was a tendency for the cheese to crack and fall apart, and this had to be prevented by careful bandaging.

(4) The cheese was slightly bitter.

(5) There was a tendency for the cheeses to develop blue mould inside.

(6) The cheeses were not of the character of Cheddar cheese, but in almost all cases they took the form of Wensleydale cheese.

The best of these experimental cheeses was submitted for criticism at a meeting of the British Dairy Institute Joint Committee at 12 Hanover Square, London, on July 26th, 1910. At this date it had been matured for 232 days (about eight months). It was of Truckle Cheddar shape, and blue mould was evenly distributed throughout it. The cheese submitted very closely resembled a good ripe Wensleydale. It was favourably commented upon, and the Committee

advised that further experiments be carried out in the making of cheese from "heated" milk.

More than half of the cheeses made in the experiment developed blue mould inside. Those, however, which failed to produce mould growth were *not* a success as Cheddar cheeses. In all cases they were soft and rich in texture, and there was a trace of bitterness in some of them.

It was evident from the results of this experiment that the cheese-maker who sets out to make a Cheddar cheese from "boiled milk" will get as a result a cheese quite devoid of Cheddar characteristics, and one resembling more closely a blue-veined cheese.

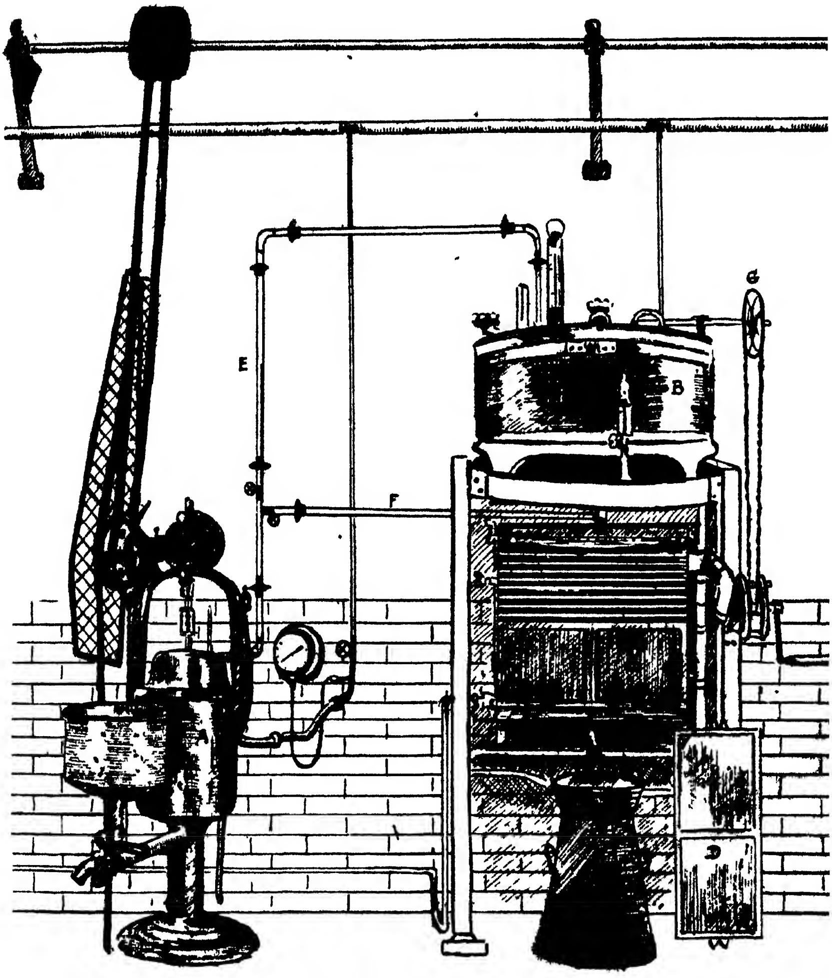
Experiments in 1911 *and* 1912.—Subsequently trials were made with milk heated to lower temperatures than 210° F. (98·9° C.), which at the same time would be sufficiently high to destroy tubercle bacilli in the milk, yet without destroying, possibly, the essential characteristics of the variety of cheese under experiment. It had been observed in trials made in October and November, 1911, that the application of carbonic acid gas to milk while being heated was beneficial in procuring a better coagulation, and it was further demonstrated that an advantage is gained by keeping heated milk from exposure to the air.

These two facts were therefore considered when some special equipment was selected for the treatment of the milk in the experiments recorded later in this article.

Utensils.—A pasteurising machine was used which is covered in as completely as convenience of working will allow. It is fitted with a very sensitive low-pressure gauge for recording the steam pressure in the heating jacket. The pasteuriser elevates the outflowing heated milk through a copper pipe to a Lawrence-Dand cooler—a vertical cooler which is provided with top and side plates fitted with cone joints which keep the milk from contact with the air while it is being cooled. The cooler will accommodate a flow of water through it to the extent of 600 to 800 gallons per hour, and each of its two sides presents a cooling surface measuring 28 by 25 inches.

At the top of the cooler is arranged a platform, upon which is placed a cylindrical milk retainer, into which milk can

be elevated through pipes from the pasteurising machine. This retainer is provided with a tightly-fitting lid which can be screwed down on to an asbestos band. The apparatus is fitted with a jacket through which steam, hot water, or



A. Pasteuriser. *B*. Milk Retainer. *C*. Lawrence-Dand Cooler. *D*. Side plate of Cooler removed. *E* Milk pipe connecting Pasteuriser and Retainer. *F*. Milk pipe connecting Pasteuriser with Cooler. *G*. Arrangement for stirring milk within the Retainer.

cold water can be passed, so that if required, the milk can be kept or "retained" at any desirable temperature for any length of time, between the heating and cooling stages, and yet at the same time be kept out of contact with the outside

air. A centrifugal stirring apparatus or vane is fitted inside and is revolved by a shaft which is driven at ten revolutions per minute by hand or belt. In this experiment, however, the retainer was not used, the milk being heated rapidly and passed at once from the pasteurising machine to the cooler. For the purpose of convenience this process is described here as "Instantaneous Pasteurisation."

Objects in View.—The chief objects in the experiments were to obtain answers to the following questions:—

1. What pasteurising temperature in the range between 160° F. and 200° F. (71·1° and 93·3° C.) gives the best result in the manufacture of Cheddar cheese from instantaneously pasteurised milk, having regard especially to the quality of the cheese?

2. What is the highest temperature to which milk may be instantaneously pasteurised without seriously affecting the characteristic properties of Cheddar cheese made from such milk?

3. Is the benefit which is derived by the aid of carbonic acid gas during the heating of the milk sufficient to warrant its regular use in the manufacture of cheese from pasteurised milk?

4. How are the properties of Cheddar cheese affected when made from pasteurised milk?

It was also held desirable to conduct the experiments on such lines as would be considered practicable in a cheese-making dairy equipped with a pasteurising machine and a covered-in cooler; two utensils which are likely to come into more popular use by those who have to deal with milk.

Treatment of Milk.—On each occasion 600 lb. of milk (composed of evening's and morning's milk in equal proportions) were made into three cheeses. The total supply was poured into a drum and was well stirred. It was then divided into three equal quantities of 200 lb., each quantity being placed in a separate cheese vat.

The first lot was made into Cheddar cheese in the usual way, the milk being warmed to 85° F. only (29·4° C.). This is referred to as the "control" vat or the "control" cheese. The second lot was heated to a high temperature in the pasteuriser, and was passed at once over a covered-in cooler. The third lot was heated similarly to the second one, but in addition a current of carbonic acid gas was passed through the pasteuriser while the milk was being heated.

The difference between the treatment of lots 2 and 3 was, that in the second lot the milk was heated in contact with

atmospheric air, whereas in the third lot the whole of the apparatus was charged with carbonic acid gas.

The first trial was made with the object of testing the pasteurising temperature of 160° F. (71·1° C.). In each succeeding trial the pasteurising temperature was increased by 5° F. until a temperature of 200° F. (93·3° C.) was reached.

It may be said that on all occasions the temperature of the heated milk as it flowed from the pasteuriser was not allowed to fluctuate. This was only assured by keeping careful watch over the machine and by observing the following conditions in the working of the pasteuriser:—

1. A steady and unvariable steam pressure in the heating jacket.
2. A regular flow of milk through the machine, and an unvariable pressure in the feeding tank.
3. No variation in the temperature of the milk when entering the pasteuriser.
4. Regular speed of the centrifugal stirrer or vane in the machine, which, it must be noted, influences the outflow.
5. Care to prevent "furring" or deposition of proteid matter on the side of the pasteuriser. Much of this "furring" is produced unnecessarily by admitting more steam than the occasion demands.

Main Difficulties in Manufacture.—The chief difficulties experienced in the manufacture of cheese from pasteurised milk are as follows:—

1. In procuring a sufficiently firm coagulation of the curd.
2. In inducing the separation of the whey from the curd.
3. In getting a satisfactory cohesion of the curd, which has a strong tendency to remain in the granular condition.
4. There is the difficulty of eliminating the surplus whey in the cheese while in press.
5. There is a risk of a development of bitterness in the ripening stage. This bitterness usually disappears in the late ripening stages, but occasionally it remains.

Observations on the Manufacture of Pasteurised Milk Cheese.—Pasteurised milk requires twice as much rennet as would be used in the case of normal milk. The whey usually presents the desirable green colour, and there is a lower percentage of total solids in the whey from curd made from pasteurised milk, as compared with that from curd from non-pasteurised milk. In the former case, therefore, there is less loss in weight by manufacture. Pasteurised milk requires a

smaller amount of starter than raw milk, as the subsequent development of lactic-acid-producing bacteria in pasteurised milk is very rapid. During the scalding stage the curd requires a longer exposure to heat, and also requires to be heated to a higher temperature.

Excessive pressure requires to be put on the curd at the time of "drawing the whey." This is most essential in order to secure a satisfactory "matting" or cohesion of the curd. Throughout the whole of the process the curd is inclined to be soft in condition, and lacks the resilient texture which is found in curd made from raw milk. This soft texture is retained in the ripe cheese, and gives to it a richness apparently superior to that found in a cheese made from raw milk. On account of the somewhat granular state of the curd, the cheese is occasionally rather loose in texture. The cheese occupies a longer period in maturing as compared with cheese made in the usual way, and when ripe it will keep good for a great length of time—in these experiments the cheeses from heated milk retained their qualities long after the control cheeses became over-ripe. At certain pasteurising temperatures it is possible to get great uniformity in the quality of the cheese.

The curd from pasteurised milk requires a smaller proportion of salt than curd from raw milk to ensure the proper degree of salinity in the ripe cheese.

It has been observed that it is a very rare occurrence to find a pasteurised milk cheese which could be termed dry. The possibility of making cheese possessing taints is practically reduced to a minimum. Where taints do exist in the cheese it is most probable that they have been introduced with the starter which is added at the beginning of the process.

Pasteurised milk cheeses require excessive pressure during the pressing stage, and cheeses of large dimensions call for very secure bandaging.

The tables on pp. 292 and 293 supply the details of the manufacture of the thirty experimental cheeses which were made in June, July, and August, 1912. The headings of the columns of figures are designed to bring out information on the important points in the manufacture which are of interest to the cheese-maker. It will be observed that the first group

of three cheeses was made on June 6th, while the last was made on August 2nd.

Notes on the Cheese-making Records.—In each group the first of the three is a "control" cheese made from raw milk according to the method generally practised in Cheddar cheese-making. The other two cheeses in each group are made from pasteurised milk, the latter one in each case being made from milk treated with carbonic acid gas, while the milk was being pasteurised.

The quantity of milk dealt with in each vat was 200 lb., which is equivalent to 19·4 imperial gallons.

In the manufacture of Cheddar cheese it is preferable to use larger quantities than 200 lb. of milk, since the temperature is better maintained, the development of acidity progresses more satisfactorily, the separation of the whey is accelerated, and a better matting or cohesion of the curd is ensured. It is permissible to say, therefore, that better results would have been obtained if each lot of milk under experiment had been 500 lb.

Tests for Acidity of Milk.—It will be noticed in the cases where the pasteurised milk has *not* been treated with carbonic acid gas that the acidity of the milk has been reduced, owing to the passing off of the carbonic acid gas naturally present.

The rennet test becomes slower as the pasteurising temperature is increased. The figures relating to the acidity tests and rennet tests are records taken after starter was added to the milks.

Starter.—Starter (milk containing souring bacteria) was added to all the cheeses at the rate of about 1¼ per cent. In the case of the cheeses made on August 1st and 2nd it was increased; in fact, in the latter case the amount was doubled. Pasteurised milk does not require more starter than raw milk, because of the very rapid development of bacteria which takes place in pasteurised milk. It is found, however, to be advisable to increase the proportion of starter where the milk has been heated above 190° F. (87·7° C.). Where the milk had been heated above this point the development of acidity was noticeably much slower throughout the whole process, and although the amount of starter was considerably increased in cheeses 26, 27, 29, 30, yet the desired amount of acidity could not be obtained in the finished curds,

CHEDDAR CHEESE-MAKING RECORDS.

Date of Manufacture.	No. of Cheese.	Milk heated to		Total Milk.	Acidity.	Rennet Test.	Amount of Starter used.	Acidity in Starter.	Fat in Milk.	Renneting Temperature.	Quantity of Rennet used.	Time of adding Rennet.	Period of stirring Rennet.	Time occupied for Rennet to show effect.	Time of cutting Curd.	Acidity in Whey at Cutting.	Temperature at Cutting.	Commencement of Scald.	Maximum Scalding Temperature.	Period occupied in raising Temperature.
1912.		Fah.		Lb.	%	Sec.	Qts.	%	%	Fah.	Dchms.	a.m.	Mins.	Mins.	a.m.	%	Fah.	a.m.	Fah.	Mins.
June 6	1	84°	—	200	0·21	21	1	0·97	3·3	84°	6⅓	10.14	3	10	11.3	0·145	83°	11.34	101°	34
,,	2	160°	—	,,	0·19	25	1	0·97	3·3	86°	13	11.22	3	5	11.59	0·13	84°	12.15	104°	40
,,	3	160°	CO_2	,,	0·2	22	1	0·97	3·3	86°	13	11.22	3	6	12.3	0·145	84°	12.20	105°	20
June 13	4	86°	—	200	0·2	21	1	0·945	3·3	86°	6⅓	11.30	3	9	12.12	0·14	85°	12.30	101°	45
,,	5	165°	—	,,	0·18	23	1	0·945	3·3	86°	14	11.25	2	5½	11.53	0·12	85°	12.25	104°	50
,,	6	165°	CO_2	,,	0·2	23	1	0·945	3·3	86°	14	11.29	2	5½	12 0	0·13	84°	12.30	105°	50
June 20	7	84°	—	,,	0·2	22	1	1·04	3·3	84°	6⅓	10.35	2	10	11.16	0·13	84°	11.30	101°	40
,,	8	170°	—	,,	0·17	28	1	1·04	3·3	88°	14	10 30	2	5	11.10	0·12	88°	11.25	102°	45
,,	9	170°	CO_2	,,	0·2	24	1	1·04	3·3	85°	14	10 30	2	5	11.5	0·13	85°	11.20	104°	45
June 27	10	85°	—	,,	0·21	21	1	0·99	3·6	85°	6⅓	10 51	2	9	11.30	0·145	84°	11.52	101°	40
,,	11	175°	—	,,	0·2	32	1	0·99	3·6	85°	14	10 53	½	7	11.38	0·135	84°	11.55	105°	50
,,	12	175°	CO_2	,,	0·2	27	1	0·99	3·6	84°	14	10.58	2	7	11.40	0·125	84°	11.50	104°	35
July 11	13	84°	—	,,	0·2	22	1	1·00	3·5	84°	6⅓	10 53	3	10	11.45	0·14	84°	11.55	101°	40
,,	14	180°	—	,,	0·19	35	1	1·00	3·5	86°	14	10 34	2	6	11.30	0·125	86°	11.54	104°	48
,,	15	180°	CO_2	,,	0·19	35	1	1·00	3·5	86°	14	10 28	2	5	11.13	0·14	86°	11.35	104°	55
July 12	16	84°	—	,,	0·2	18	1	0·98	3·3	84°	6⅓	10.47	1	8	11.45	0·15	85°	12.5	101°	15
,,	17	185°	—	,,	0·185	34	1	0·98	3·3	86°	14	10 56	1	8	11.55	0·13	86°	12.30	104°	60
,,	18	185°	CO_2	,,	0·22	32	1	0·98	3·3	86°	14	10.40	2	7	11 50	0·13	86°	12.30	104°	55
July 18	19	84°	—	,,	0·21	20	1	1·11	3·7	84°	6⅓	10.32	2	10	11.15	0·135	83°	11.35	101°	40
,,	20	185°	—	,,	0·2	37	1	1·11	3·7	84½°	14	10.54	1	8	11.40	0·125	84°	11.55	104°	24
,,	21	185°	CO_2	,,	0·215	35	1	1·11	3·7	84°	14	10.52	2	7	11.31	0·125	83°	11.51	104°	19
July 25	22	85°	—	,,	0·22	22	1	1·10	3·6	85°	6⅓	10 35	3	12	11.20	0·135	84°	11.40	102°	35
,,	23	190°	—	,,	0·19	42	1	1·10	3·6	86°	14	10.38	2	9	11.30	0·1	84°	12.5	104°	35
,,	24	190°	CO_2	,,	0·22	37	1	1·10	3·6	85°	14	10.37	3	7½	11.35	0·11	84°	11.55	104°	30
Aug. 1	25	84°	—	,,	0·21	22	1½	1·01	3·3	84°	6⅓	11 6	3	11	11.51	0·135	83°	12.10	102°	32
,,	26	195°	—	,,	0·19	49	1½	1·01	3·3	85°	14	11.12	2	8	12.2	0·135	85°	12.16	108°	27
,,	27	195°	CO_2	,,	0·22	37	1½	1·01	3·3	85°	14	11.11	3	9½	12	0·145	85°	12.14	109°	30
Aug. 2	28	85°	—	,,	0·19	20	2	0·98	3·9	85°	6⅓	11 8	2	9	11.50	0·16	84°	12.3	101°	33
,,	29	200°	—	,,	0·13	51	2	0·98	3·9	85°	14	11.12	2	8	12.12	0·15	85°	12.28	104°	37
,,	30	200°	CO_2	,,	0·2	50	2	0·98	3·9	85°	14	11.13	3	9½	12.12	0·14	85°	12.27	104°	37

CHEDDAR CHEESE-MAKING RECORDS.

Date of Manufacture.	No. of Cheese.	Time when stirring stopped.	Time of racking Curd.	Time of drawing Whey.	Acidity in Whey while being drawn.	Fat in Whey.	Time of grinding Curd.	Acidity in Whey from press.	Hot iron test.	Weight of Curd.	Weight of Salt.	Temperature of Curd.	Time put to press.	Total solids in Whey from vat.	Maximum Pressure.	Weight of new Cheese.	Weight of ripe Cheese when matured **3 months.**	Weight of ripe Cheese when matured **7 months.**	Condition of Milk before Pasteurisation.	Points awarded by the Judges.
1912		p.m.	p.m.	p.m.	%	%	p m		ins.	lb	oz	Fah.	p.m	%	cwt	lb	lb	lb.		%
June 6	1	12.40	12.45	1	0·175	0·1	5	1·15	2	22	7⅓	70°	5.20	5·88	10	22	19	17½	No trace of taint.	84
,,	2	1.5	1.10	1.20	0·15	0·2	5	·94	1¾	23	5¾	72°	5.20	6·23	15	22½	19	17		93
,,	3	12.55	1.10	1.25	0·16	0·15	5	·935	1½	22½	5¾	72°	5.20	5·9	15	21½	18½	17		93
June 13	4	1.30	1.40	1.50	0·165	0·1	5 20	1·08	2	23	7⅓	70°	5.35	6·97	10	21½	19	16½	Slightly tainted.	63
,,	5	1.10	2	2.10	0·15	0·15	5 17	1·15	2	21½	5½	74°	5.35	8·07	15	20½	18¾	17		94
,,	6	1.30	2	2.10	0·155	0·1	5 15	·915	2	22	5¾	74°	5.30	7·05	15	21	19	17½		94
June 20	7	12 30	12.40	1 5	0·165	0·1	4 15	1·14	2	21½	7	71°	4 30	5·55	10	20½	19	17½	Very slightly tainted	79
,,	8	12 30	12 40	1	0·155	0·2	4.30	1·1	1¾	23	5¾	76°	4.40	6·83	20	21	19	17½		100
,,	9	12.20	12.30	12 55	0·15	0·15	4 20	1·08	2	22½	5¾	72°	4 35	5·96	20	21	19¼	17½		93
June 27	10	12.45	1.5	1 20	0·18	0·1	5 30	1·15	2	22¼	7⅓	72°	5 45	7·71	10	21½	19¾	18½	Slightly tainted.	78
,,	11	12.50	1.10	1.25	0·15	0·1	5 50	·95	1½	23¾	6	76°	6.5	7·08	20	22½	21	18		82
,,	12	12.50	12.55	1.15	0·165	0·05	5 40	·98	1½	24	6	74°	6	6·77	20	23½	21	18		89
July 11	13	1.5	1.15	1.25	0·17	0·15	5.5	1·03	2	22½	7⅓	74°	5 30	7·1	10	20	18½	17½	Clean flavoured milk.	87
,,	14	1.10	1.25	1.50	0·155	0·2	5 15	1	1½	24	6	80°	5 35	6·97	20	22½	19½	18		83
,,	15	1	1.25	1 50	0·17	0·2	5.20	·88	1½	23½	6	86°	5 45	6·67	20	22	19½	18		96
July 12	16	12.45	12.55	1 15	0·18	0·05	3.30	·95	2	22½	7½	80°	4 45	7·08	10	20	18	17	Clean flavoured milk.	91
,,	17	2.10	2.12	2 30	0·2	0·2	5.20	1·11	2	22½	5½	80°	5 45	7·05	20	21½	18¾	17½		47
,,	18	1.45	2	2.30	0·23	0·1	5.15	·89	1½	24	6	84°	5.40	6·85	20	23½	19¼	17½		48
July 18	19	12.50	12.55	1.15	0·17	0·15	4	1·15	2	22½	7½	70°	5	6·84	10	21	18¾	18	Clean flavoured milk.	85
,,	20	1.10	1.15	1.27	0·15	0·25	4 30	·91	1½	25	6½	75°	5 20	7·27	20	23½	20¾	20		72
,,	21	1	1.6	1.17	0·15	0·25	4 40	·72	¼	25	6½	73°	5	6·7	20	24½	21½	20½		82
July 25	22	12.30	12.45	1.5	0·165	0·2	4.30	1·19	2	23	7⅔	72°	5 45	9·4	10	21	19	19	Milk unusually clean in flavour.	99
,,	23	12.50	1.15	1.30	0·14	0·15	5.15	1·17	1½	24½	6½	74°	5 50	6·7	25	23½	20¾	19		66
,,	24	12.50	1.15	1.35	0·145	0·1	5 20	·935	1¼	24½	6½	75°	5 48	6·8	25	23½	20¾	19½		94
Aug. 1	25	1	1.15	1.30	0·165	0·2	4.30	1·02	2	23	7⅔	74°	5	8·01	10	22	20	19	No taint.	86
,,	26	1.15	1.36	2	0·155	0·1	4.55	·81	1	25½	6¼	77°	10	6·85	25	24½	21¾	20½		83
,,	27	1.15	1.36	2	0·16	0·15	4.50	·6	¾	25¼	6¼	77°	10	7	25	25	22	20½		79
Aug. 2	28	1.5	1.9	1.14	0·18	0·2	4.13	·99	2	24	8	73°	4.40	7·14	10	22½	20¾	19½	No taint.	98
,,	29	1.25	1.55	2.10	0·205	0·3	5.30	·8	1	25	6¼	79°	10	6·97	25	25	22¼	22		89
,,	30	1.15	1.55	2.10	0·185	0·2	5 30	·8	1	26	6½	76°	10	6·2	25	26	23	22		87

even after allowing a further ripening or souring period of five hours previous to pressing. It will be noticed that in the case of these four cheeses the curds were ground and salted at about the usual time, but they were kept in the moist state in their moulds to develop further acidity before pressing at 10.0 p.m.

It would appear that when milk is heated to 195° F. (90·5° C.) and above, some change is produced in the milk whereby the souring bacteria introduced with the starter are robbed of some condition essential to their propagation. This suggests a doubt as to whether the bacteriologist gets the best results in his milk cultures when the milk used as the medium has been sterilised at high temperatures.

Rennet.—A liberal amount of rennet was added to the "heated" milk; this necessitated great care in the mixing of the milk and rennet to avoid what is termed "over-stirring" of the curd.

State of Curds.—The curds from the "heated" lots of milk were at all times weaker and softer in condition than those from the raw unheated lots (see p. 290). The curds from the pasteurised milks treated with carbonic acid gas were more firmly coagulated than those from the untreated pasteurised lots, but this difference in the coagulation was not evident when pasteurising temperatures above 175° F. were reached; in fact, the difference was hardly noticeable at 175° F. (79·4° C.).

Tests of Whey.—The loss of fat in the whey was much the same in all cases.

Cutting of the Curd.—The curds from the heated milks were cut extremely fine at the breaking stage. This fine cutting is most essential in order to promote the separation of the whey from the curd.

Scalding Temperature.—The curds of cheeses Nos. 26 and 27 were heated to 108° F. and 109° F. respectively, but this high temperature had the effect of very seriously hindering the "matting" or consolidation of the curd. The matting of the curd presents a difficulty at all times when manufacturing pasteurised milk. It is believed that 104° F. (40° C.) is the most desirable maximum temperature to which the curd should be heated where the object is to promote whey drainage.

Drawing of the Whey.—At the period when the whey is drawn the curd requires considerable pressure in order to consolidate it. If the curd can be made to cohere well at this stage, there will be little trouble in the process afterwards. The column which is headed "fat in whey" gives the results of butter fat tests of the whey which was drawn from the cheese-making vats.

Weight of Curd.—In practically all cases there is a greater weight of curd from the pasteurised milks owing to the retention of albumin, which is mostly lost in the manufacture of cheese from raw milk. A great portion of the albumin of milk coagulates at the high pasteurising temperatures and enters into the composition of the cheese. Thus it will be seen that where there is a great weight of cheese, there is a correspondingly low percentage of total solids in the whey, as in cases Nos. 27 and 30.

Salt.—The curds of the control cheeses were salted at the rate of 1 oz. of salt to 3 lb. of curd (the usual allowance in Cheddar cheese-making), while those from the pasteurised milk were salted at the rate of 1 oz. to 4 lb. of curd. Notwithstanding this reduction in salt in the latter case, all the cheeses made from the pasteurised lots of milk tasted too salt when ripe. It is evident that the pasteurisation of the milk imparts to the cheese a condition partaking of the nature of salt.

Ripe Cheese.—The cheeses were weighed weekly during the ripening stage, and the figures given are those recorded at the time when the cheeses had matured for three months. In the case where the milk was heated to the higher temperatures there is an increase in weight of cheese as compared with the control cheeses to the extent of from 5 to 9 per cent.

All the cheeses were judged on November 18th, 1912, and they were further matured until February 18th, 1913, by which time many of the control cheeses had become over-ripe, while the pasteurised milk cheeses had greatly improved. Samples of cheeses Nos. 11, 15, 24, and 29 were widely distributed amongst those interested in the experiment, and others who are expert judges of cheese. (It may be mentioned that the best milk handled in the experiment was that from which cheeses Nos. 22, 23, and 24 were made. This milk was

perfectly clean in flavour and, as the development of acidity in the curd progressed, there was not the slightest trace of taint.) The curd of the control cheese No. 22 was one of unusual merit as regards texture and flavour. This curd, in fact, was a record one.

The experiment of July 12th was repeated on the 18th, as the results obtained in manufacture were not satisfactory; the results on the second occasion were considerably better. The following is probably the explanation of the trouble which was experienced on July 12th, when the coagulation of the pasteurised milks was unsatisfactory. At that period the milk was being received at a low temperature from the farms, and the effort of heating this cold milk to 185° F. was over-taxing the capacity of the pasteuriser, with the result that the milk was being held too long in the machine while in a heated state. This slow heating no doubt affected the coagulative properties of the milk. On subsequent occasions, therefore, the milk was warmed to a temperature of 110° F. before passing it through the pasteuriser, so that the machine could deal with it more rapidly. While milk is being raised from 65° to 185° F. in a pasteuriser, and is subsequently passed through ten feet of pipes in the heated state, it must necessarily be exposed to heat for a considerable time—probably too long to ensure successful coagulation of the milk. It was noticeable that while there was evidence of taint or undesirable flavour in the curds of the control cheeses, the taints were not perceptible in the curds from the pasteurised milks.

Appointment of Judges.—In the selection of judges to judge the experimental cheeses, two experts were appointed. It was deemed desirable that one should be an expert maker who has had experience in the judging of cheese at the important shows, and that the other should be an experienced cheese buyer. Mr. John Benson and Mr. Robert Pigott were invited to judge the cheeses.

The cheeses were numbered, and the judges were given no intimation whatever as to how any one of the cheeses was made. They were merely aware of the fact that a certain number of the cheeses had been made from pasteurised milk. The cheeses were judged by points, and the following is a copy of the scores gained in each case:—

COPY OF JUDGES' AWARDS.

Date of manufacture.	Number of cheese.	Milk heated to	Flavour 35.	Quality 30.	Texture 15.	Colour 10.	Finish 10.		100 Marks maximum total.	Judges' remarks.
1912.		Fahr. degrees.								
June 6	1	84	25	28	15	8	8	Control	84	
	2	160	30	28	15	10	10	Not treated with gas	93	
	3	,,	35	30	10	8	10	With gas	93	
June 13	4	86	20	20	8	8	7	Control	63	Chalky
	5	165	30	30	15	9	10	Not treated with gas	94	
	6	,,	35	30	10	9	10	With gas	94	
June 20	7	84	25	25	12	7	10	Control	79	
	8	170	35	30	15	10	10	Not treated with gas	100	Excellent cheese
	9	,,	32	30	13	8	10	With gas	93	
June 27	10	85	25	20	15	8	10	Control	78	
	11	175	25	25	13	9	10	Not treated with gas	82	Bitter
	12	,,	30	30	10	9	10	With gas	89	
July 11	13	84	30	28	12	8	9	Control	87	Blue
	14	180	25	28	13	9	8	Not treated with gas	83	Slightly bitter
	15	,,	32	30	15	9	10	With gas	96	
July 12	16	84	32	27	12	10	10	Control	91	
	17	185	15	10	7	7	8	Not treated with gas	47	
	18	,,	18	10	7	7	6	With gas	48	
July 18	19	84	25	28	13	9	10	Control	85	
	20	185	15	27	12	9	9	Not treated with gas	72	Very bitter
	21	,,	25	28	12	8	9	With gas	82	
July 25	22	85	34	30	15	10	10	Control	99	
	23	190	20	20	10	8	8	Not treated with gas	66	Very bitter and chalky
	24	,,	30	30	15	10	9	With gas	94	
Aug. 1	25	84	28	26	15	8	9	Control	86	Very ripe
	26	195	25	25	15	9	9	Not treated with gas	83	Bitter
	27	,,	22	24	15	9	9	With gas	79	
Aug. 2	28	85	33	30	15	10	10	Control	98	
	29	200	30	27	15	9	8	Not treated with gas	89	
	30	,,	28	26	15	9	9	With gas	87	

The marks awarded by the judges to the three groups of cheeses are allotted as follows:—

	Control cheeses.	Cheeses from pasteurised milk.	Cheeses from pasteurised milk treated with carbonic acid gas.
June 6th	84	93	93
,, 13th	63	94	94
,, 20th	79	100	93
,, 27th	78	82	89
July 11th	87	83	96
,, 12th*	91*	47*	48*
,, 18th	85	72	82
,, 25th	99	66	94
Aug. 1st	86	83	79
,, 2nd	98	89	87
	Total score 850	Total score 809	Total score 855

* The experiment of July 12th was repeated. If the scores of July 12th cheeses were not counted in the totals, the total figures would read:—

759	762	807

By dividing the latter totals by nine, the following are the average points gained by each cheese in the respective groups:—

84·3	84·6	89·6

It will be seen that the scores of the cheeses of July 12th were in favour of the control cheeses, and that if the records of these cheeses had been excluded, the judges' awards would have been wholly in favour of the two groups of pasteurised cheeses, and the control cheeses would have come last in the order of merit. As has been pointed out, the failure of the July 12th cheeses was due to manufacture, but they have been recorded because they serve to illustrate an important lesson.

The bitterness in the cheeses (observed by the judges in five cases) was to be found only in two cheeses (Nos. 23 and 26) after a six months' ripening period had been completed.

The records and results of the experiment appear to show that in the manufacture of Cheddar cheese from pasteurised milk the best cheeses are made when the milk has been pasteurised at temperatures ranging from 160° to 170° F. When such pasteurising temperatures are employed there is a greater uniformity in the results.

In cases where there are taints present in milk, the cheese-making qualities of such milk can be improved by pasteurisation. The same remark applies to milk which is known to produce cheese which is not of the first grade. The manufacture of cheese from milk pasteurised to temperatures not exceeding 170° F. demands less skill on the part of the cheese-

maker than the manufacture from milk heated to higher temperatures. Apparently none of the Cheddar cheese characteristics are lost where the milk has not been heated above 170° F.

Conclusions.—(1) The judges' awards show that it is possible to make Cheddar cheese—capable of scoring 87 to 94 per cent. of points for merit—from milk which has been pasteurised to temperatures ranging from 190° to 200° F. (87·7° to 93·3° C.). The points lost by these cheeses were principally on the score of flavour, and from this it may be assumed for the present that, with the increase of the pasteurising temperature above 180° F., the cheeses lose a little of their characteristic Cheddar flavour, but not to a serious extent.

(2) Carbonic acid gas, artificially added to milk during pasteurisation, improves the coagulative properties of milk to a considerable extent when the lower pasteurising temperatures are employed, but it was noticeable that the gas had not this beneficial effect upon the coagulation in the pasteurising temperatures above 180° F. (82·2° C.).

The best cheese made in the experiment was made from pasteurised milk which was not treated with gas at all. The pasteurising temperature was 170° F. (76·6° C.).

(3) Carbonic acid gas appeared to serve a useful purpose in preventing bitterness, a fault which occurs sometimes in pasteurised milk cheeses, more especially in their earlier ripening stages. The gas was used at the rate of about ½ lb. to each cheese, and cost 6*d*. per lb.

(4) Cheeses made from milk treated with carbonic acid gas were found to fail in colour (as regards the colour of the cheese internally). The cheeses made from the non-pasteurised milk were very obviously more clear in colour and gained more points in this respect.

(5) As compared with cheeses manufactured from raw milk, those made from pasteurised milk are softer and more plastic in texture, while they also appear to be more soluble; and these properties give the impression that there is a high percentage of butter-fat present in the composition of the cheese.

This apparent richness is a special feature of pasteurised milk cheeses, and in this respect a great advantage is gained by pasteurisation.

To make the difference in the results between the two methods as clear as possible we will take a sample of Cocksfoot and divide it into two equal parts, and compare the two processes.

Purity.—

First Method—used on the Continent.

1. Separate sample into:—
   (*a*) Pure seeds.
   (*b*) Other good seeds.
   (*c*) Weed seeds.
   (*d*) Inert matter or rubbish.

"Pure Seeds" include only seeds with well-formed kernels. The undeveloped seeds are either blown out by fans or the sample is examined under a diaphanoscope and those that contain no kernels, or only partly developed ones, are taken out and included among the rubbish. Where portions of spikelets of grasses, such as Cocksfoot, consisting of two or more seeds are found in the sample, such portions are counted as one seed.

2. Weigh each lot.
3. Calculate the percentages.

Second Method—adopted by the Agricultural Education Association.

1. Separate sample into:—
   (*a*) Pure seeds.
   (*b*) Other good seeds.
   (*c*) Weed seeds.
   (*d*) Inert matter or rubbish.

"The term 'Pure Seeds' shall include all seeds of the species under examination, whether ripe or unripe, poorly or fully developed. In the case of grasses a combined flowering glume and pale shall be counted as a seed, whether the caryopsis is present or not. Where portions of spikelets of grasses, such as Cocksfoot, consisting of two or more seeds are found in the sample, such portions must be separated into their single constituents by hand."

2. Weigh each lot.
3. Calculate the percentages.

Germination.—Count out two or more lots of 100 pure seeds and place on blotting paper, &c., in the germinator. Count those that germinate.

When tested by the first method the "pure seeds" which are taken for the germination test include only picked seeds, whereas when tested by the second method the "pure seeds" include all seeds, good and bad.

The analyses of two samples— one (A) of good and one (B) of inferior quality—which were examined recently will illustrate the difference between the two methods.

	First Method. A.	First Method. B.	Second Method. A.	Second Method. B.
Purity.				
Pure Seeds	99·2	92·6	99·5	97·3
Other Good Seeds	0·2	0·6	0·2	0·6
Weed Seeds	0·2	1·8	0·2	1·8
Inert Matter	0·4	5·0	0·1	0·3
Germination	92·0	86·0	88·0	64·0

In both samples there is a smaller proportion of pure seeds and a higher percentage of germination by the first method than there is by the second method, but the difference in the inferior sample is very much greater than in the good sample —in fact, the worse the sample the greater is the difference.

There has probably been great confusion in the minds of those who, having bought seeds which were guaranteed by the first method, got them tested, and the results recorded by the second method.

Not only does the second method give a much better indication of the comparative quality of different samples, but it is also fairer both to sellers of good seeds and to buyers.

BROKEN SEEDS OF CLOVERS.—Many samples of clovers—especially red clover—contain broken seeds. By some authorities such seeds are included among the pure seeds, and given a chance to grow; by others they are included among the rubbish. The Agricultural Education Association has decided to include them in the rubbish.

In many cases broken seeds are evidently neglected altogether. Some years ago the writer was struck with a sample of red clover which was being sold with a guaranteed purity of 99 per cent. and a germination of 99 per cent. On careful examination it was found to contain about 10 per cent. of broken seeds; so that in the purity test these had obviously been included among the pure seeds, and when the lots for the germination test were counted out they were passed over. This procedure was unfair.

HARD SEEDS.—In many samples of clover seeds there is a varying percentage of "hard" seeds. These seeds are quite good and fresh, but the outer skin has become so tough that water is unable to pass through it, and the seeds therefore do not germinate readily.

By some authorities all the "hard" seeds are added to the number germinating; by others, a varying proportion, usually one-third or one-half. Here, then, we have another source of differences in results. By the Agricultural Education Association's scheme the percentage of hard seeds is stated separately.

VALUE OF GERMINATION TESTS.—Many persons are sceptical as to the value of germination tests. Two arguments are usually brought forward against this test:—

1. That seeds may grow under favourable conditions in the germinator, but will not grow when sown in the field.

It is quite true that some seeds will grow in the former conditions and not in the latter. Why? There are two reasons: (*a*) Some seeds are very weak, but under the favourable conditions of the germinator will germinate, and if those conditions are continued may ultimately form healthy plants. This is well seen in the case of greenhouse seeds. It is a well known fact that many of the finest plants have been produced from the weakest seeds, which under more adverse conditions would never have grown. In ordinary field culture the favourable conditions very rarely continue, and the young plants produced from such seeds die. The *germinating energy* gives a very good indication of the number of such weak seeds present. By this term is meant the number of seeds that grow in a few days, strong and healthy seeds germinating first. (*b*) The conditions of the soil may be such that the seeds cannot grow, *e.g.*, it may be too dry, consequently there is not sufficient moisture for the process of germination. This was well seen in 1911, in which year, it will be remembered, the rainfall was low, and whole fields of what should have been grass were ploughed up owing to the seeds not germinating. Again, the soil may be wet and cold, and the seeds instead of germinating will rot. This is often seen where there are wet spots in a field; on these spots there are very few plants, and those that are present have a sickly appearance, while on the rest of the field there may be sufficient plants. Again, the seeds may be eaten by birds, or the young plants injured by insects and die. Because these calamities occur the verdict is passed by many people that a knowledge of the percentage of germination of samples of seeds is useless. It is not claimed that a test will show how many seeds will grow under adverse conditions. All that is claimed is that it can tell whether the seeds are *capable* of growing or not. Many seeds bought and sown are not capable of growing under any conditions whatever. It is for the farmer to try to make the conditions fit for their healthy growth.

2. That the percentage of germination gives no indication of the crop that the seeds will produce.

A sample of foreign red clover may have a high germinating capacity and still may not be able to produce such a good crop in the field as a sample of English red clover, the percentage of germination of which is much lower. Or, again, germination tests show two varieties of turnips to be equal, but when grown side by side in the field one is capable of producing several tons per acre more roots than the other.

Many persons reason from such examples that a knowledge of the percentage of germination of the seeds is useless. The possession of information as to germination does not mean that information on other points should be neglected. A knowledge of the "strain" or "pedigree" is also essential. It would be better to have a sample with a good pedigree and a comparatively low germination rather than a sample with a bad pedigree and a high germination, but it would be still better to have a sample with both a good pedigree and a high germination.

GUARANTEES.—It is held by many that every lot of seed should be sold with a guarantee of purity and germination. With the principle one may agree, but not with the usual practice, and for three reasons: (1) because seeds sold by different dealers are not tested under the same conditions. If one dealer gets his seeds tested at one place and another gets his tested at a second place, there are sure to be differences in the results, especially if different methods are used. (2) It is not enough merely to state the percentage of purity. It may give little information to a farmer to tell him that the purity of a sample is 95 per cent. He also wants to know what the impurities are, whether they are weeds, or good seeds, or rubbish, and what proportion of each is present. The data relating to two samples of perennial rye-grass will illustrate the importance of this point:—

Example showing two samples of Perennial Rye-grass with a Purity of 95 per cent.

		No. 1.	No. 2.
Pure Seeds	... ...	95·0	95·0
Impurities	Other Good Seeds	4·4	0·1
	Weed Seeds	0·2	3·1
	Rubbish	0·4	1·8

Here, although the purity of both samples is the same, there is a considerable difference in the quality, No. 2 having about fifteen times as many weed seeds as No. 1.

(3) It is impossible to get exactly the same results with several samples from the same lot of seed, and therefore a margin is usually allowed for variation. Unscrupulous dealers are able to utilise this fact. Several years ago a dealer called the writer's attention to a sample of cocksfoot that he had bought, with a guaranteed germination of 86 per cent., from another dealer. On being tested it did not come up to the guarantee, and when the form with the original test was procured it showed the germination to be 81 per cent. A footnote stated that 5 per cent. must be allowed for variation in the results of the different samples. The dealer had added the allowed margin to the result of the test. One can imagine a case where a comparatively inferior sample might pass through the hands of three or four such dealers. If each on selling were to add the allowed margin to the guarantee that he got from the other, the sample would finally appear to be a very good one. To obviate such cases, the actual results of the test should be stated on each sample bag and on the label on each bag of the bulk.

HOW TO USE SEED TESTS TO THE BEST ADVANTAGE.—Until some better and uniform system is introduced farmers can get considerable assistance from some of the agricultural colleges.

In the north of Scotland, for example, several farmers have adopted a method that not only enables them to get the best seeds, but also the best value. Briefly, the method is as follows. A number of farmers combine and secure samples and quotations of prices from various dealers. The samples are examined without referring to the prices, and those that are obviously bad are rejected. The remainder are sent to the agricultural college, where all the samples are tested by the same methods and under the same conditions. It is then quite easy, by comparing the results and prices, to select the best values of each kind of seed. Samples of the bulks are then compared with the original samples. On several occasions there have been considerable differences between them, the bulk being much inferior to the sample.

INCREASING THE DURABILITY OF TIMBER.*

THE growing scarcity of many kinds of timber and the increased cost of timber generally have necessitated the use of some preservative to protect it from decay, especially in view of the fact that something like 80 to 85 per cent. of the timber used is lost by decay, the remainder being sacrificed to fire, insects and mechanical destruction. Creosote oil has been found to be a most useful preservative of timber, and even when the process of creosoting was effected by simple absorption, its advantages were clearly apparent; but since the introduction of the method of creosoting timber under pressure more than 60 years ago, the durability of wood, when properly treated with creosote, has been more conclusively demonstrated. The employment of creosoted timber, moreover, by increasing the durability of wooden structures, has tended to diminish the cost of repairs. In connection with the use of creosoted timber for buildings and fencing for small holdings, the question of the cost of creosoted, as compared with that of untreated timber, as well as the relative value of the process in its application to timber of various kinds, is very important.

Cost of Creosoting under Pressure.—Dealing first with the question of cost: Messrs. English Bros., of Wisbech, state that the process of creosoting adds from 15 per cent. to 25 per cent. to the cost of the timber, but as it more than trebles the durability of exposed woodwork, the economy of its use is evident. Upon inquiry, they supplemented this statement with the information that the cost of properly creosoting under pressure by Bethell's process adds from 4*d*. to 6*d*. per cubic foot to the cost of wood, according to the quantity of oil stipulated. In this connection, they recommend from 8 to 10 lb. of oil per cubic foot of wood, the cost of the treated timber at present prices ranging from 2*s*. to 2*s*. 5*d*. per cubic foot according to locality. Different kinds of timber absorb varying amounts of creosote.

Messrs. Armstrong Addison and Co., of Sunderland, state

* This memorandum was drawn up by the Departmental Committee of the Board on Duration of Buildings and published in the Report of the Departmental Committee of the Board on Buildings for Small Holdings. Cd. 6708; price, 11*s*. 3*d*. (now published at 1*s*. 6*d*.).

that the cost of creosoting depends on the quantity of oil injected, but may be put at from 4½*d.* to 5*d.* per cubic foot; and that "kyanising," which is usually employed when wood has to be painted, or where there is special danger of fire, costs from 9*d.* to 10*d.* per cubic foot. They add that the cost of the process which they employ (an alternative process to either creosoting or kyanising, in which metallic salts in solution are used instead of creosote, and the liquid is forced into the timber under pressure) is only slightly more than that of creosoting, and as the salts are fire-resisting the process is very usefully employed for estate or farm purposes.

Mr. W. B. Havelock, a great authority on the subject of creosoting home-grown timber, whose experience in this connection has extended over a period of eighteen years, stated that the present price of creosote such as he uses delivered to his station was 4¼*d.* per gallon,* plus the carriage of the empty casks, which practically added another farthing to the cost. As the prices of creosote had risen recently, the estimate that creosoting under pressure now costs from 4*d.* to 6*d.* per cubic foot was not an unreasonable one.

The Rüping Process.—It is worthy of notice that the cost of creosote oil has practically doubled during the last twenty years; there is therefore obvious advantage in any process tending to economy in the amount of creosote required for effective treatment.

It is well known that creosote does not permanently solidify in timber, but will always return to a liquid state when the temperature of the air is high enough. The result is that, with ordinary methods of creosoting, much of the oil wastes in course of time by exudation from the cells; even when the timber is in a horizontal position exudation takes place to some extent. A process which is claimed to avoid this waste has been employed in Germany for the last eleven years, and worked in this country by arrangement with the patentees by Messrs. Richard Wade, Sons and Co., Ltd., of Hull. The object of this process is to saturate thoroughly the fibre or cell walls with the preserving liquid without leaving any in the interior of the cells. The operation consists

* A gallon of creosote oil weighs about 10½ lb.

in first subjecting the timber to a considerable air pressure and then forcing in the creosote under still higher pressure. After releasing the pressure a quantity of the surplus oil is forced out by expansion of the contained air, and a vacuum may be applied to assist in drawing off any oil which may still remain in the interior of the wood cells. It is claimed that by these means only so much oil is retained as has been absorbed by the cell-walls and is needful to preserve the timber from decay, and further that the timber is dry and clean to handle. Owing to the economy in the amount of oil used, the cost of this process, at the present price of creosote, is only about 3½*d.* per cubic foot, while, as has already been stated, the cost of creosoting under pressure in the ordinary way cannot be put at less than from 4*d.* to 6*d.* per cubic foot.

It is understood that the general adoption of this process in connection with the treatment of telegraph poles is under the consideration of His Majesty's Postmaster-General, and that its employment for certain classes of poles has already been decided upon; it is estimated that the cost of creosoting, calculated on the present price of creosote and the existing standard of impregnation (12 lb. per cubic foot), will be reduced by about 20 per cent.

Quantity of Creosote Absorbed.—With regard to the relative quantity of creosote absorbed by various kinds of timber, the experience of Mr. W. B. Havelock goes to show that timbers of the pine species, viz., Scotch, Austrian and Corsican pines, take creosote oil very freely; in fact, if these timbers are fairly dry, enough oil (or nearly so) for practical purposes will be absorbed by simple immersion for a stated period. Beech is one of the easiest kinds of wood to creosote, while larch and spruce are amongst the most difficult. Nevertheless, if spruce is dry and is subjected to pressure for a long enough period, it will absorb sufficient oil. Speaking generally, simple immersion is of very little value.

It may be affirmed that the amount of creosote absorbed by timber depends mainly on:—

(1) the species;

(2) the age of the timber and the extent to which heart-wood has developed in it;

(3) the structure and texture of the timber, and more particularly the relative proportions of thick-walled and thin-walled elements;

(4) the rapidity of growth;

(5) the amount of moisture present in the timber;

(6) the exact composition of the creosote oil, its temperature, and the method of its application to the timber.

It seems to be established that young rapidly-grown coniferous timber with slight heartwood development will take up far more oil than matured timber with well-developed heartwood, and that timber grown in open stands will absorb far more creosote than the close even-grained material taken from the close forest.

Other Methods of Preserving Timber.—*Carbolineum* probably stands next to creosoting in increasing the durability of timber, and is better than paint, since it penetrates the wood and sterilises it to a certain extent. On account of its great covering power it is very cheap in application, one gallon covering from 30 to 50 square yards according to the nature and surface of the wood. One great advantage, moreover, arising in connection with the use of carbolineum, consists in the fact that it can be varnished to improve its appearance, without in any way impairing its action as a preservative. *Solignum* is another preservative, the use of which has been attended with satisfactory results. On the whole, however, it does not seem probable that any method of preserving timber will supersede the process of creosoting under pressure, whether regard be had to true economy in outlay, or to the efficacy of the treatment.

DANISH TUBERCULIN-UNIONS.

JOHN J. DUNNE.
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THE attempt to eradicate tuberculosis amongst domestic animals has not been made with that strenuousness and energy which the nature and prevalence of the disease demand. Tuberculosis very considerably diminishes the annual profit on cattle and pigs. A substantial proportion of the oxen slaughtered in the public abattoirs in Denmark are found to be suffering in greater or less degree from tuberculosis, and it has been stated that 2 per cent. of all adult cattle in Denmark are suffering so seriously from the disease that they would be rejected by the meat inspectors. As the result of a very contagious type of tuberculosis of the udder eight hundred cows are slaughtered yearly, on the average, as a measure of public safety. Over 4 per cent. of the two million swine which are slaughtered yearly in the Danish export abattoirs are found to be suffering from the disease in a more or less acute form.

In addition to the actual losses caused by the rejection of their carcasses when killed, it must be remembered that tuberculous animals during their lifetime consume as much fodder as healthy ones, while at the same time they are unable to make so profitable a use of it.

Further, farmers cannot afford to be indifferent to the foreign market for stud cattle. At present, most countries refuse to permit the importation for breeding purposes of animals which have not passed the tuberculin test.

Tuberculosis can be eradicated from amongst our domestic animals. In 1890–93 Professor Bang showed that the farmer could transform a tuberculous stock of cattle into a healthy one, since the tuberculous cows, as a rule, breed sound non-tuberculous calves, which continue to be healthy when they are not unduly exposed to contagion. This fact forms the basis of Professor Bang's system for the eradication of the disease, which may be explained as follows:—

The farmer first inoculates his entire stock of cattle with tuberculin. It is then divided into two herds, a reacting

herd and a non-reacting herd, which are kept strictly isolated. The calves of both herds are included in the non-reacting herd, and inoculated with tuberculin when a few days old. If they stand the test, they are permitted to live; otherwise they are slaughtered. Their daily ration of milk is pasteurised.

The entire non-reacting herd is tested once or twice yearly with tuberculin. After each test any animals reacting are transferred to the reacting herd. If the farmer prefers not to inoculate the adult cattle, these are classified as reacting, and the non-reacting herd is gradually recruited from young cattle alone. This system, which has stood the test of time and actual practice, is recognised both in Europe and America as the best system for the eradication of the disease.

The Danish Government recognised Bang's system, and by a law of April 14th, 1893, with later amendments, set aside the sum of £2,780 (later £5,560) yearly, to be placed at the disposal of farmers who made use of the system. But this subsidy has not been utilised to the extent desired. From April, 1893, until the end of 1911, subsidies were given in respect of 12,203 different herds of cattle. This is a large number in itself, but is small in proportion to the number of cattle in the country.

There were 667 herds of cattle tested in 1910, and of these 267 were tested for the first time. There were 27,250 animals tested altogether, and of these 11·9 per cent. reacted. Of the 400 herds of cattle which were tested prior to 1910, only the non-reacting animals were inoculated, together with the calves and the animals purchased in the course of the year. They numbered 22,212 head all told, and of these only 5 per cent. reacted.

Had farmers adopted Professor Bang's system when it was first introduced twenty years ago, it might well be that the disease would be stamped out by this time. There are, however, several reasons which explain the farmers' lack of interest in the matter.

There is the slow progress of the disease, the consequence of which is, that most farmers do not become aware of it until the greater number of their stock are attacked, and individual cows are suffering from it in an acute form.

Many farmers are deterred by the mistaken view that Bang's system involves too much trouble and expense.

In the cattle-raising districts, where many prize cattle are sold for stud purposes, the farmers refrain from adopting the system, lest the rumour that some of their cattle had not stood the tuberculin test should damage the sale of their stock. They cannot be brought to realise that customers would rather buy animals from the non-reacting part of the herd than from amongst a stock of non-inoculated cattle.

An example, however, of what can be done is afforded by the tuberculin societies which have been formed in various parts of Denmark. The Tuberculin-Union of Remkold will serve as an illustration. It was founded by Mr. N. O. Nielsen, veterinary surgeon, in 1905. Its rules are briefly as follows:—

1. To become eligible for membership the farmer must have had his cattle inoculated with tuberculin.

2. He must divide his stock into two herds: one reacting, the other non-reacting.

3. He must keep the herds in distinct cowsheds, and provide them with separate pasturage and attendants. If possible, they should be isolated on different farms.

4. He must thoroughly disinfect the cowsheds, troughs, and all utensils used by the non-reacting herd.

5. He must have his healthy herd inoculated with tuberculin every six months.

6. He must remove the calves of the reacting herd and feed them either on milk from the non-reacting herd or on pasteurised milk.

7. He must not add any calves to the healthy herd except those which have given non-reacting symptoms to the tuberculin test made when the calves are some days old.

8. He must not add any cattle bought at a market to the healthy herd without previously submitting them to the tuberculin test.

9. He must sterilise the milk of the tuberculous cows before using it as food, either for man or beast.

10. He must immediately get rid of the reacting animals that show clinical symptoms of the malady.

The Union started with 29 members, and has now 155. Of the 155 herds of cattle 91 were healthy when their owners

joined the Union, while the remaining 64 were reacting. At present 135 of the herds are non-reacting, and only 20 reacting. The members have now 2,947 healthy cattle all told. Only two of the members have large herds of cattle: they have 800 and 300 head respectively. The other members have only 40 head or less; many of the members are small farmers possessing only 3 or 4 acres. Of the two large herds one is thoroughly healthy, while the one with 800 cows includes 80 reacting cattle.

In forty-two of the herds the disease has been completely eradicated, and these belong to small farmers, of whom it has been repeatedly said that they have great difficulty in isolating the reacting from the non-reacting herds. Practical experience has shown that, where the farmer has the will to do so, these difficulties can be overcome.

Remkold and its neighbourhood will, it is hoped, shortly be completely free from the disease, owing to the work of the Union, and there is every likelihood of its becoming a centre for the sale of healthy cattle to other parts of Denmark. In this way the Union will mean a direct pecuniary gain to the members who have stamped out the disease.

Manual Processes of Agriculture.

THE Eighth Report of the Rural Education Conference [Cd. 6871] (price 3*d.*) deals with instruction in the Manual Processes of Agriculture. The Conference were asked by the Board of Agriculture and Fisheries "to inquire into the methods which Local Education Authorities adopt with the object of promoting efficiency in the performance of manual processes, *e.g.*, ploughing, hedging, ditching, sheep-shearing, milking, and basket-making, and to advise as to any further action that may appear to be desirable for the purpose of developing skill in workmen employed in agriculture."

With regard to the instruction of children of elementary school age the Report points out that in a few counties provision is made for children attending classes in manual agricultural processes, such as milking, hedging, and thatching, and the Conference consider that such instruction is of great value in interesting boys and girls in agricultural

pursuits, and, when given by a capable teacher and under proper supervision, the result is entirely beneficial. They accordingly recommend that other counties should consider the adoption of a similar system in their rural areas. The Conference also express the opinion that if more farmers gave employment, combined with explanatory instruction, on their farms to boys during the school holidays and paid them a suitable wage for their work, the interest which most boys now take in farm work when they leave school would be very greatly increased. The tendency for them to seek employment in the town rather than to remain in the country would be materially checked, and their skill as agriculturists would be considerably developed.

The bulk of the Report deals with the provision of instruction for boys and men who are already employed upon the land. In half the counties in England and Wales no provision is made by the Local Education Authority for instructing agricultural labourers in manual processes. The Conference received striking evidence not only as to the value of the instruction in the counties in which it is being provided, but also as to the need for such in counties in which no provision for this type of instruction has been made, and they accordingly recommend all Local Education Authorities to provide instruction in manual processes for young farmers and agricultural labourers.

The method adopted by most counties which make provision for instruction in these subjects is to employ itinerant instructors. The work of the instructors is to conduct classes at suitable centres, and in some cases, by arrangement with the farmers, to visit farms in order to give workmen instruction in their ordinary employment. As in all forms of education, the value of instruction in manual processes depends more on the capability of the instructor than on any other factor. It is stated, however, that great difficulty is experienced in finding suitable instructors in manual processes. Two reasons have been given for this: (1) that there are few men who combine the ability to teach with exceptional skill in the performance of the process (such skill being, of course, essential in a practical instructor); and (2) that where such men do exist, they are not willing to engage in instruc-

tion unless they are certain of obtaining permanent employment. To meet the second of these difficulties the Conference recommend that a county which cannot usefully employ the whole services of an instructor should combine with a neighbouring county or with neighbouring counties for the purpose. With regard to the first difficulty, it is suggested that if instructors are carefully selected and their work is regularly supervised by the County Agricultural Organiser or Lecturer, their ability to impart their knowledge to others will undoubtedly improve. For this reason the employment of one or more permanent instructors is recommended rather than the employment from time to time, as required, of local instructors, although there may be in certain districts local practices which may make the employment of local instructors preferable.

The duration of the instruction provided in different counties varies considerably. The Local Government Board Auditors do not permit Local Education Authorities to award prizes in connection with competitions unless the competitors have previously received instruction. In some counties, in order to comply with the requirements of the Auditors, instruction of a nominal character is provided, and many of the students attend the classes more with a view to qualify for the competitions than as a means of instruction. The Conference consider that public money should not be expended on the provision of merely nominal instruction for students who are for the most part proficient. They recognise that the award of money prizes is open to abuse, but are not prepared to recommend that they should be entirely discontinued. They suggest that Local Authorities should take precautions to prevent men already proficient from attending classes in order to win the prizes, and recommend that the value of the prizes given by Local Authorities should be strictly limited in amount and should vary in accordance with the thoroughness of the course. The Report recommends that the courses of instruction at present provided in most counties should be made more thorough and that Local Authorities should offer the payment of a small sum to each pupil as "attendance money," such sum not to exceed the amount lost in wages.

The Growth of the United States Department of Agriculture.

AN account of the development of the Department of Agriculture in the United States during the last sixteen years is given in the Report of the Secretary of Agriculture for 1912. During these sixteen years it is stated that new bureaus have been created and existing ones enlarged; lines of research, investigation and demonstration have been multiplied; the Congress of the United States has imposed ever-increasing duties on the Department from year to year; and the body of expert advisers to the Department has greatly increased both in numbers and in the variety of services rendered. The following information is given of the increase in the Department's activity in certain directions:—

Cost of the Department, Staff, and Publications.—The budget of the Department in 1897–8 was £682,000; it increased to £1,481,000 in 1905, and by 1907 it had risen to £2,725,000. Mainly as a result of additional duties in connection with food laws and the care of the national forests, the budget had risen by 1912 to £4,352,000, and the expenditure sanctioned for 1913 is £5,155,000. The staff of the Department has grown from 2,444 persons in 1897 to 13,858 in 1912. The activity of the Department is reflected in its publications, and some idea of the enormous growth in recent years may be gathered from the fact that in 1897 the different publications printed were 424, of which 6,541,210 copies were issued, while in 1912 the publications numbered 2,110 and the copies issued 34,678,557.

Plant Industry.—The Bureau of Plant Industry was founded twelve years ago. Its aims are briefly to ascertain what imported plants or crops grown in other parts of the world can be usefully produced in the United States; to secure new varieties of plants by breeding and selection; to control destructive diseases; to open new markets for plant products, and to improve methods of handling, shipping, and marketing farm produce. The Bureau has six field propagating stations, and it is stated that 34,000 different varieties of plants have been introduced and their progeny distributed to experiment stations and private experimenters and plant breeders. As examples of the work in this direction may be

mentioned the introduction of improved varieties of rice from Japan, China and India, of drought-resisting wheat from Russia, of oats and barley from Sweden, and fruits from all parts of the world. Special success seems to have attended the introduction of forage crops, more particularly sorghum, soy beans, lucerne and grasses. Varieties of cotton, maize, sugar beet, and tobacco have been greatly improved as a result of the work of the Bureau. Important work has also been done as regards methods of cultivation suitable in the "dry farming" districts to the east of the Rocky Mountains. An "Office of Dry-Land Agriculture" established by the Bureau about six years ago has now six experiment stations in North and South Dakota, Colorado, Oklahoma, Texas and New Mexico.

The Bureau maintains a central seed testing laboratory at Washington and five branch laboratories, and more than 120,000 samples of seeds have been tested for purity and germination. The Secretary of Agriculture states that as a result of the information which has been issued, the sale of adulterated lucerne and clover seed has practically ceased, and the quantity of other adulterated forage plant seed on the market is now small in comparison with what it formerly was.

Another part of the work of the Bureau of Plant Industry is known as the Farmers' Co-operative Demonstration Work. At its inception this work consisted in the maintenance of farms in the cotton-growing districts for the purpose of demonstrating methods of combating the cotton boll weevil, but the work has been gradually extended until it is now a comprehensive system of instruction in general agriculture. In 1912 the Department of Agriculture had 858 agents conducting demonstrations in the field, while 35,000 farmers were taking part in the work.

Entomology.—The Bureau of Entomology has thirty-five field laboratories in different parts of the United States, nearly all of which are admirably fitted for investigation work on insects. The most important investigations of the Bureau have related to the San José Scale, the Cotton Boll Weevil, and the Gipsy and Brown Tail Moths.

Soil Investigations.—The sum voted for the Bureau of Soils

in 1912 amounted to £55,000. The work on soil investigation was undertaken in the first place to allay the fears that the soils of the United States would ultimately become exhausted. As a result of the investigations it appears that all cases of reported soil exhaustion are due to bad cultivation, to the lack of proper adaptation of soils and crops, to the unwise rotation of crops and to the misuse of fertilisers and manures.

Soil surveys have been conducted over an area of 623,000 square miles, the soils classified, and their characteristics, methods of cultivation, and suitable crops discussed.

Animal Industry.—Prior to 1897 the work of the Bureau of Animal Industry related almost entirely to diseases of animals and meat inspection. It now includes animal breeding and feeding, dairying investigations, the organisation of cow-testing associations, the marketing of dairy produce, meat inspection, the inspection and quarantine of imported animals, stamping out diseases of animals, and scientific investigations into animal diseases.

Weather Bureau.—The Meteorological Service in the United States is a Bureau of the Department of Agriculture. Its cost increased from £184,000 in 1896–7 to £338,000 in 1912–13. The Bureau issues weekly weather forecasts, daily weather maps, and special warnings of the approach of storms, frost and cold. The forecasts are distributed by post, telegraph, telephone and rail. Special stations are maintained in fruit-growing districts, so that warnings as to approach of frosts may be given as quickly as possible; in these districts, also, experiments are undertaken to discover the best methods of protecting crops from frost.

Experiment Stations and Education.—The experiment stations in the United States in 1897 employed 628 persons and had a total income of £235,000, while in 1911 they employed 1,567 persons and their income was £763,000. In addition to their own experimental and research work, these stations co-operate with the Department of Agriculture in numerous lines of work and have been instrumental in carrying the Department's work to the individual farmer.* The "Experiment Station Record," published by the Office of

* For further particulars as to these Experiment Stations, see *Journal*, October, 1911, p. 591.

Experiment Stations, reviews the world's literature on scientific agriculture.

In 1897 there were 61 colleges giving instruction to 4,000 students in agriculture; in 1911 the 67 State agricultural colleges enrolled almost 18,000 students, and there were also 42 privately endowed colleges giving courses in agriculture. Very few agricultural colleges gave opportunities for graduate study prior to 1897, but 43 colleges now hold graduate courses in agriculture. There were only 9 agricultural high schools in 1897, as against 78 in 1912. There are also 289 public high schools which receive State aid for courses in agriculture, domestic economy, and farm mechanics, Minnesota alone giving £26,000 a year for these purposes. Over 1,600 other high schools give instruction without State aid. Agriculture in the elementary schools had hardly been thought of in 1897, whereas now nearly every State in the Union gives some encouragement to such teaching, and nineteen require it by law.

The work of aiding in the development of farmers' institutes was officially undertaken by the Department of Agriculture in 1903. In 1902 institutes were held to the number of 2,772, with an attendance of 819,995 and with aid from the State legislatures amounting to £30,000. The total number of meetings in 1911–12 was 7,079, and the attendance at the regular institutes was 2,483,028. The amount given in State aid was £107,000.

Improvement of Live Stock in Scotland.

THE Board of Agriculture for Scotland, immediately after their formation, undertook the duty of assisting in the improvement of live stock in Scotland. By the 31st December, 1912, they had completed nine months' work, an account of which is given in their First Report [Cd. 6757, price 5½*d*.]

Ponies.—The Board succeeded to a stud of Highland ponies, and the ten stallions of this stud were distributed through various Highland pony breeding districts, in addition to which premiums were awarded to eight stallions privately owned, to serve in various districts. The fees charged for the service

of small landholders' mares were 7*s.* 6*d.* in all except two districts, where they were 5*s.*

The Board do not regard the hiring of pony stallions as a satisfactory or economical arrangement, and they propose to bring up their own stud to the requisite strength. For this purpose two stallions were purchased during the year, as well as several promising yearling colts which, it is hoped, will grow into valuable stallions.

Premiums were awarded in respect of nine Shetland pony stallions, which served small landholders' mares in the various districts of the Shetland Islands.

Horses.—The Board assisted the small landholders in a few districts by paying a proportion of the fees charged for the service of Clydesdale stallions, which were hired by the local Committees.

Throughout the rest of Scotland a scheme was put into operation under which the subscriptions of small holders to the horse-breeding societies are paid by the Board up to, but not exceeding, 10*s.*, and the Board pay half the fees for the service of small holders' mares up to a maximum of £2 10*s.* In the opinion of the Board the benefits are sufficient to induce small holders to become members of horse-breeding societies and thus to secure the services of superior sires, and the larger funds available to the societies through the increased subscriptions and more numerous service fees will attract owners of better class stallions.

The schemes of the Board of Agriculture and Fisheries with regard to light horse breeding have been adopted, with some modifications, by the Board of Agriculture for Scotland, and the regulations as to the registration of stallions in Scotland have been made uniform with those in England and Wales.

Cattle.—Assistance in the breeding of cattle has been given to small landholders in several counties

(*a*) by supplying bulls, the property of the Board (the bulls, while remaining the Board's property, were placed in the charge of local Committees, who were responsible for their maintenance); and

(*b*) by paying premiums of the value of £10 each to the owners of good class bulls available for the service of small landholders' cows at a moderate fee.

Under the scheme the following bulls are owned by the Board:—203 Highland, 24 Shorthorn, 17 Aberdeen Angus, and 1 Ayrshire. Premiums have been granted in respect of 12 Aberdeen Angus and 2 Shorthorn bulls. A further scheme has been prepared, but is not yet in operation, which involves the granting of a limited number of premiums to approved bulls of the Shorthorn, Aberdeen Angus, Galloway, Ayrshire, and Shetland breeds, whose owners place the services of the bulls at the disposal of small holders at a nominal fee.

Sheep.—In the nine months ended 31st December, 1912, the Board granted the use of 470 rams (312 Blackface and 158 Cheviot) to Township Committees in crofting parishes at a fee of 10*s*. per ram, the rams being delivered free of expense to the crofters.

The Board also offered, to Crofter Committees which should hire approved rams from neighbouring farmers, to pay a proportion of the cost, not to exceed 30*s*. in the case of any one ram. Under this part of the scheme 81 rams were provided for 29 townships.

Several Township Committees took advantage of the Board's offer to supply them with Border Leicester rams at half price. In all the Board lent out, or sold, 8 rams of this breed.

Pigs.—In order to encourage pig breeding and to improve the breed, the Board have offered premiums of £5 to the owners of approved boars.

Poultry.—When the Board came into existence a scheme organised by the Congested Districts Board for the distribution of sittings of eggs of pure breeds was in full operation. There had been established 56 stations from which eggs of pure breeds were being distributed to crofters and cottars resident in congested areas at the price of 1*s*. per dozen, the Congested Districts Board supplementing this price by granting a bonus of 1*s*. 6*d*. per dozen to the managers of the stations. The eggs produced at these stations were not sufficient to supply the demand, and arrangements had been made with certain breeders outside of the congested areas to supply eggs, for which the applicant paid 1*s*. per dozen, and the Congested Districts Board made up the difference between this sum and the prices charged by the suppliers, this

difference varying from 2*s.* to 4*s.* per dozen. It fell to the Board of Agriculture to complete the operations under this scheme. During the season there were distributed from the stations established in congested areas 2967 sittings, and from other breeders 374 sittings.

For the present season the Board decided to extend the scheme to the whole of Scotland, and accordingly applications were invited from farmers and others who possessed, or were prepared to purchase, suitable pure-bred stock, and were prepared to distribute from them eggs for hatching purposes on the same terms as under the Congested Districts Board scheme. As in a great many districts in Scotland it would be impossible to find suitable persons to undertake the management of stations without some addition to, or renewal of, their stock and equipment, the Board offered to assist them by giving a grant of half the purchase price of a house and stock, provided both were approved by the Board. One hundred and forty-nine egg-distributing stations have thus been established. The sole object of the scheme is to bring about a general improvement both in the quality of the poultry and in the system of management. To secure the former, an opportunity is afforded to all poultry-keepers to get, at a small cost, reliable sittings of eggs from sound, healthy, pure breeds; while to secure the latter, the local supervision of the working of the scheme devolves on the Poultry Instructors employed by the three Agricultural Colleges. These Instructors, whose chief duty hitherto has been to deliver courses of lectures and to give practical demonstrations, will now be brought into close contact, not only with those who distribute the eggs, but with those who obtain them, and they will thus be enabled to give, at the homes of poultry-keepers, such practical hints and advice as may be applicable to each individual case.

Shows.—The support of live stock shows is an important feature of the schemes for the improvement of live stock. This support took the form of grants varying in amount from 50 per cent. to 75 per cent. of the prize money awarded in classes confined to small holders, and grants for special prizes for heifers and fillies, conditional upon these remaining in possession of the owner for at least twelve months after the date of the show.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Radio-active Manures (*Ann. de l'Ecole Nat. d'Agric. de Grignon*, 1912).—Laboratory experiments were carried out at the School of Agriculture at Grignon in 1911, and 1912 with regard to the effect of small quantities of oxide of uranium on plants. The oxide of uranium was added in amounts of from 0·05 to 1·00 per thousand to a nutritive solution made up according to Knop's formula (*i.e.*, in which one litre of distilled water contained 1 g. nitrate of calcium, 0·25 g. nitrate of potassium, 0·25 g. phosphate of potassium, 0·25 g. sulphate of magnesium, and traces of phosphate of iron). Kidney beans (*haricots*), barley, and maize were grown in the solutions (both pure, and with varying quantities of oxide of uranium added). Increased weight of plants was obtained with kidney beans after 50 days as the result of adding various amounts of uranium, the greatest being obtained from the addition of 0·25 per thousand of oxide of uranium. Varying results were obtained from barley; 38 days after germination the addition of 0·05 per thousand of oxide of uranium gave increased weight of plants, while quantities above this gave negative results. A decreased weight of plants resulted with maize in the case of all quantities of oxide of uranium added.

A radio-active manure (the radio-active element being uranium) was obtained by the School from the *Banque du Radium*. The latter gave its activity as 0·05 uranium, but from examination in the laboratory its activity appeared to be less than that of 0·01 of oxide of uranium, U_3O_8.

In experiments on wheat in the laboratory, the manure was added to the nutritive solution mentioned above in amounts varying from 50 g. to 500 g. per litre. The radio-active manure was found to have a favourable effect on the weight of the plants—although it must be noted that these experiments had reference only to the first stages in the life of the plants.

Field and pot experiments were carried out on wheat, rye, barley, oats, leguminous, forage and oleaginous plants, linseed, potatoes, Jerusalem artichoke, and helianthi, the manure being added in very small quantities to the manures ordinarily employed (*e.g.*, from 1 to 10 per cent. of the quantity of superphosphate).

No definite conclusions are drawn, in the report under notice, from the experiments; but it would not appear to be advantageous to use more than 27 to 45 lb. of catalytic manure per acre along with superphosphate. It is pointed out that radio-active manures seem to be more efficacious with a complete mixture of artificials than with a nitrogenous or phosphatic manure alone; with the complete dressing the quantities which give the best results seem to be from 36 to 45 lb. of the catalytic manure per acre.

The number of experiments in which increases (+) and decreases (−)

* A Summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

in the crop resulted from the use of the radio-active manure are shown in the following table :—

	Radio-active manure alone.	With superphosphate.	With dried blood.	With superphosphate and dried blood.	With complete mixture of artificials.
Total weight of crop	6+; 8−;	12+; 1=; 15−;	1+; 1−;	2+;	2+; 1−;
Foliage and straw, &c.	7+; 6−;	18+; 1=; 20−;	1+;	—	2+; 1−;
Seeds	6+; 8−;	17+; 22−;	2+; 1−;	2+; 1−;	2+; 1−;
Tubers	1+; 9−;	4+; 2−;	—	—	12+; 4−;

Fertilising Property of Sulphur (*Russisches Journal für experimentelle Landwirtschaft,* 1912, *V. V. Sabaschnikoff, Bull. of Agric. Intell., Mar.,* 1913).—The writer conducted experiments on a very rich clay soil to ascertain whether flowers of sulphur had any effect on the growth of barley and rye.

The soil analyses gave an average sulphuric acid content of 0·082 per cent. The sulphur was applied before sowing at the rate of about 90 lb. per acre. The sowing was done on Feb. 25th. The plants on the treated plots were stronger and had a brighter green colour than those on the untreated plots. The beneficial effect of the sulphur was visible up till harvest.

Fertilising Property of Sulphur (*Comptes Rendus des Séances de l'Académie des Sciences, Vol.* 159, *No.* 9, *M. A. Demolon. Bull. of Agric. Intell., May,* 1913).—It is shown that sulphur is converted into calcium sulphate in the soil, and that the phenomenon is of a biological nature. Further, its fertilising action is due partly to its effect on the soil bacteria, and partly to the chemical properties of the sulphuric acid which is formed gradually, and which not only supplies sulphur to plants but also helps to dissolve mineral elements in the soil.

FIELD CROPS.

Varieties of Oats (*Edinburgh and East of Scotland Coll. of Agric., Rept. No.* 29, 1913).—The trials reported on were carried out in the seasons 1909, 1910, 1911, and 1912 at fifty-two centres in eleven counties. At each centre six varieties were grown on selected land on plots of ¼ acre, and at all the centres the Potato Oat was used as the standard. Twenty-seven varieties were tested, and in order to secure that approximately the same number of seeds per acre should be sown, 180 lb. per acre of Potato Oats were taken as a standard, this amount containing about 3,000,000 seeds, and all the plots were seeded at this rate.

The amount of seed required per acre varied from 4·3 bush. (Potato and Hamilton) to 7·7 bush. (Newmarket). It is pointed out that equal seeding in this sense does not necessarily result in equally thick crops, for varieties differ considerably in tillering power. Some, like Potato Oat, throw out many shoots and tend to give a thick crop; whereas others, like Excelsior, produce few shoots, and often no more than one from each seed that grows. As a rule, those varieties which produce large, heavy grain tiller less abundantly than those of the Potato type,

and consequently the seeding must be proportionately more liberal to produce a satisfactory yield per acre.

From tables showing the relative values of the several varieties grown under varying conditions of soil and climate the following points are noted :—

Potato.—As compared with the standard Potato Oat, seven varieties —viz., in order, Victory, Golden Rain, Beardless Propsteier, Wideawake, Record, Beseler, and Yielder—surpassed it by from 20 to almost 40 per cent. in yield of grain; while Banner, Waverley, White Propsteier, Hvitling, and Abundance were better by 15 or 16 per cent. None of these varieties, on the average of all the centres, showed themselves equal to Potato in the production of straw; but in a number of cases, particularly on heavy soil, Beseler and Wideawake yielded more straw than the standard.

Hamilton.—This oat produced 18 per cent. more grain and 17 per cent. more straw than the standard at the higher altitudes.

Wideawake.—At six high-lying centres this oat came out on an average 39·5 per cent. better than Potato; on light land, at lower altitudes, 32·6 per cent. better; and on heavy land, 13·4.

Record produced 27·5 per cent. more grain and 10 per cent. less straw than the standard.

Beseler was better than Potato at all but one of twenty-five centres, giving 21 per cent. more grain and only 2 per cent. less straw. It is stated to be very suitable for land in high condition, where it may yield 50 per cent. more grain than Potato and an equal amount of better standing straw.

Yielder surpassed the standard by 23 per cent. in grain, while in weight of straw it came within 5 per cent. of it. It did better on the loams than on the heavier soils. On account of its early ripening it is specially suited for late districts.

Abundance, Banner, and Waverley did best on good loams at the lower altitudes, where they beat the standard by 20 to 23 per cent. in grain; in straw they gave 4 to 8 per cent. less than the standard.

Victory, Beardless Propsteier, and Golden Rain, three of the new Swedish varieties, did remarkably well, giving respectively 39, 37, and 36 per cent. more grain, and on the average 10 per cent. less straw than Potato.

Varieties of Potatoes (*Harper Adams Agric. Coll., Rept. on Field Expts.*, 1912).—A trial of early varieties was made on a light soil overlying red sandstone to compare the cropping power and length of time required to produce a profitable crop. Half an acre was planted with the following varieties :—Eclipse, Edina, Express, John Bull, Midlothian Early, and New Success. The seed was obtained from Midlothian. The ground received 12 tons of farmyard manure per acre in winter, a dressing of 3 cwt. of superphosphate and 1 cwt. of sulphate of potash at the time of planting, and 1 cwt. of nitrate of soda—half at the time of harrowing down the ridges when the shoots appeared, and the remainder when the crop was moulded up. Unsprouted sets were planted on February 28th and 29th.

All the varieties were well through before the end of April; moulding up was completed about the middle of May; and lifting commenced on June 20th. The varieties were ready for digging in the following

order :—Express, Midlothian Early, Edina, Eclipse, New Success. John Bull was a failure. A portion of each was reserved and lifted in August, when the following yields per acre were obtained :—

Variety.	Ware.		Seed.		Chats and Diseased.		Total.	
	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.
Edina	3	17½	1	9	1	6¾	6	13¼
Midlothian Early	3	15	1	8¾	1	4	6	7¾
Express	3	2¼	1	11¾	1	2½	5	16½
Eclipse	2	18	1	6½		17¼	5	1¾
New Success	1	17¼		17¼	1	4½	3	19

In a further trial with small quantities of the same varieties which were sprouted before planting on April 6th, the order of ripening was :—Midlothian Early, Express, New Success, Eclipse, Edina; and it was found that better shaped and cleaner skinned tubers were obtained than in the case of the early planted and unsprouted "seed," which indicates the value of boxing the "seed" of early varieties. It is stated that of the five varieties, Midlothian Early and Express were the most profitable, while Midlothian Early and New Success were best as regards quality. In a trial of a large number of early, mid-season, and maincrop varieties the best as regards quality were :—Early Varieties: Early Favourite, Early Russet, and Early Short Top. Mid-season Varieties: Dalhousie Seedling, Snowball, and Recorder. Maincrop Varieties: Redskin Flourball, Laird, Monarch, Eastern Planet, and Peckover.

Spraying with Bordeaux Mixture.—This mixture in solution was applied in the following strengths :—2 lb. to 20 gallons of water, and 2 lb. to 15 gallons, at the rate of 50 gallons per acre, to the variety Conquering Hero on July 3rd, and again on July 26th. It was found that while there was practically no difference between the yields on the plots sprayed with different strengths, there was an increase in the sprayed plots over the unsprayed of ware 1 ton 6 cwt. 1½qr., and seed 5 cwt. 1½ qr. per acre.

Report on the Results of Rotation Experiments (*Prof. Douglas A. Gilchrist, M.Sc.*).—This Report on the Peepy (Northumberland) Rotation Experiments, 1894–1909, was drawn up in 1911 by Prof. Gilchrist. Four four-course rotations had been completed. The rotation followed in each case was swedes, barley, hay, and oats.

The soil is a sandy loam, which becomes a clay loam at the bottom of all the plots; it is probably derived from the Millstone Grit formation, but Boulder Clay is present at the lower end of the field. An analysis of the unmanured plot showed it to consist of 90 per cent. of fine sand, the remainder being gravel, stones, and coarse sand.

Twenty ¼-acre plots received special manurial treatment, details of which are given in the Report, together with the yields, money values, and gains from the various treatments of the four crops during the years 1906–1909.

The general conclusions drawn are :—

1. About 12 tons good dung applied to swedes in the drills at the time of sowing, and complete artificials for the hay crop (the nitrogenous manures as a top-dressing in spring, the phosphatic and other manures

in early winter), have given the best results and considerably the greatest gain.

2. It is not nearly so satisfactory to apply dung and artificials together for the turnip crop.

3. It is not desirable to apply nitrogenous manures to the barley crop. If so, the chances of the barley becoming "lodged" are greatly increased, and consequently harm will be done to the young grass and clover seeds.

4. On this light soil a potash manure gives excellent results when artifical manures only are used.

5. Twelve tons good dung will probably grow as good swedes as the same with artificials in addition, especially if the previous hay crop has been dressed with a phosphatic manure like basic slag, and a potash manure if necessary. Dung is best applied in the drills at the time of sowing the swedes.

6. The barley crop is better not manured for two reasons :—

(*a*) There is a risk that the barley will not be as good for malting.

(*b*) A laid crop of barley damages the young seeds, and also injures the grain and straw. When the barley crop is harvested, about 5 cwt. per acre of high quality basic slag, and on light land either 1 cwt. muriate of potash or 4 cwt. kainit, should be applied. In the spring a top-dressing of 1 cwt. nitrate of soda might be applied to the young seeds, unless clovers are abundant, when this would be withheld. The following oat crop might be advantageously top-dressed with 1 cwt. nitrate of soda, unless it is anticipated that this would make the oat crop too luxuriant.

7. As showing the gradual rate of exhaustion on the plot which received no manure for sixteen years, the values of the four crops of each rotation (per acre) were as follows :—

First rotation	£33	1	0
Second rotation	24	5	0
Third rotation	15	10	0
Fourth rotation	19	7	0

The swede crop suffered much more from soil exhaustion than the other three crops.

LIVE STOCK AND FEEDING STUFFS.

Calf Feeding Experiments (*Journal Dept. of Agric. for Ireland, April,* 1913).—During the years 1901 to 1903 inclusive, a series of calf feeding experiments were carried out, the main results of which are given in the following summary :—

1. Although calves fed for a considerable period on whole milk will show a high rate of increase as compared with the gain in weight made by animals reared on other foods, the increase is obtained at too great a cost to be profitable.

2. It is much more economical to use separated milk along with a butter-fat substitute after calves are from four to six weeks old.

3. The best financial results were obtained from the calves fed on separated milk and a calf meal composed of 1 part ground flax seed, 2 parts oat meal, 2 parts maize meal. Whilst this meal gave distinctly

the best results, it cannot be claimed that it is necessarily the best that can be devised. Wheat meal, as a rule, is about 2*s.* 6*d.* per cwt. lower than oat meal, and if used as a substitute for the latter in the standard calf meal, it would result in a saving of 1*s.* per cwt.

With a view to testing the relative values of oat meal and wheat meal as ingredients in a calf meal, the Department in 1912 commenced a series of calf feeding experiments, details of which are given below.

This experiment was conducted at fifteen centres with two even lots of 60 calves, whose average age was seven and a half weeks. The experiment lasted 117 days.

The meal mixtures fed to the two lots were as follows:—Lot I.: 1 part ground flax seed, 2 parts maize meal, 2 parts oat meal. Lot II.: 1 part ground flax seed, 2 parts maize meal, 2 parts wheat meal. The total and average gains in live weight made by each lot of calves were as follows:—

Lot.	Number of calves.	Total increase.		Average increase.		Average daily increase.
		cwt.	lb.	cwt.	lb.	lb.
I. Oat meal mixture... ..	60	100	2	1	74	1·59
II. Wheat meal mixture..	60	98	8	1	71	1·57

The cost of production (concentrated foods and milk only) was:—

Lot I.	Oat meal mixture	15*s.* 7*d.*	per cwt. live weight.
Lot II.	Wheat meal mixture .	15*s.* 5*d.*	" "

It is concluded that two meal mixtures are of practically equal value at the prices mentioned, but the Department do not consider it advisable to modify their recommendations as to the use of the oat meal mixture until the results of further tests are available.

Cattle Feeding Experiments (*Journal Dept. of Agric. for Ireland, April,* 1913).—Two experiments were designed to compare the relative values of home-grown and imported feeding-stuffs when fed to grazing and stall-fed cattle.

Experiment A. With Cattle on Grass.—This experiment was carried out at six centres with two even lots of 26 cattle. Lot I. received a mixture consisting of 1 part wheat meal, 1½ parts barley meal, 2 parts ground oats; whilst Lot II. was given a corresponding quantity of the following mixture: 1 part maize meal, 2 parts undecorticated cotton cake.

The cattle were grazed in separate fields as similar in size and quality as could be selected; as a further precaution, however, the two lots were changed from one pasture to the other weekly or fortnightly. At the beginning of the experiment the amount of the mixtures given per head daily was 3 lb.; it was afterwards increased to 4 lb., and finally to 5 lb. towards the close of the fattening period.

The average duration of the experiment was 79 days. The following tables give the increase in live weight and the cost of production (food only) in both lots.

Live Weight Increase.

Food.	Number of Cattle.	Average weight at beginning.	Average weight at close.	Average increase in 79 days.	Average daily gain.
		Cwt. lb.	Cwt. lb.	Cwt. lb.	Lb.
Home-grown	26	7 69	9 57	1 100	2·70
Imported ...	26	7 84	9 56	1 84	2·48

Cost of Production (Food Only).

Food.	Cost of concentrated food (less manurial value).	Cost of grazing.	Total cost of foods.	Total live weight increase.	Cost of producing 1 cwt. live weight increase.
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	cwt. lb.	£ *s.* *d.*
Home-grown ...	23 15 4	29 6 10	53 2 2	49 24	1 1 7
Imported	20 11 10	29 6 10	49 18 8	45 56	1 1 11

The figures in the foregoing tables show (1) that the cattle fed on the home-grown foods made a total of 3 cwt. 80 lb., or 16 lb. per head greater increase in live weight than those fed on imported foods, and (2) that the cost of production was 4*d.* per cwt. of live weight increase cheaper in the case of the home-grown foods.

Experiment B. With Stall-fed Cattle.—This experiment was conducted at nine centres with two equal lots of 36 cattle. The basal ration in each case consisted of roots, hay, and straw. In addition, Lot I. received a mixture consisting of 1 part wheat meal, 1½ parts barley meal, 2 parts ground oats; whilst Lot II. was given the following mixture: 1 part decorticated cotton cake, 2 parts maize meal. (At seven centres part of the decorticated cotton cake was replaced by linseed cake during the finishing process.) In every other respect the two lots of cattle were treated alike. The same quantity of the mixtures of concentrated foods was fed to each lot; at the commencement 3 lb. per head daily were given, and the quantity was gradually increased until, in some cases, as much as 10 lb. were supplied. The experiment last on an average 85 days. The following tables give the increase in live weight and the cost of production (food only):—

Live Weight Increase.

Food.	Number of cattle.	Average weight at beginning.	Average weight at close.	Average increase in 85 days.	Average daily gain.
		cwt. lb.	cwt. lb.	cwt. lb.	lb.
Home grown	36	9 82	11 12	1 41	1·79
Imported	36	9 76	11 14	1 50	1·91

Cost of Production (Food Only).

Food.	Cost of concentrated food (less manurial value).	Cost of roots, hay, and straw.	Total cost of foods.	Total live weight increase.	Cost of producing 1 cwt. live weight increase.
	£ s. d.	£ s. d.	£ s. d.	cwt. lb.	£ s. d.
Home-grown ...	53 2 10	78 10 7	131 13 5	49 20	2 13 6
Imported	57 16 7	78 10 7	136 7 2	52 8	2 12 5

It will be seen from the foregoing tables (1) that the cattle fed on imported foods made a total increase of 2 cwt. 100 lb., or 9 lb. per head over that made by the cattle fed on home-grown foods, and (2) that the cost of live weight production was 1*s.* 1*d.* per cwt. less in the former case.

Conclusion.—Considered as a whole, the results are so closely similar that for all practical purposes it would appear that no superiority can be claimed for either class of concentrated foods at the following prices per cwt. :—Wheat meal, 8*s.*; barley meal, 7*s.*; ground oats, 6*s.* 8*d.*; maize meal, 7*s.* 6*d.*; undecorticated cotton cake, 6*s.* 6*d.*; decorticated cotton cake, 9*s.* 6*d.*; linseed cake, 10*s.* 6*d.*

Pig Feeding Experiments (*Journal Dept. of Agric. for Ireland, April,* 1913).—Experiments were designed by the Department in 1912 with a view (1) to ascertain the value of potatoes for the production of pork, and (2) to compare the relative values of barley meal and maize meal for fattening pigs.

I. *Potatoes and Meal versus Meal alone.*—This experiment was carried out at ten centres, at each of which the pigs selected were divided into two equal lots as even as possible as regards age, weight, and quality.

Both lots were treated exactly alike in every respect, except that Lot I. received a certain quantity of potatoes in addition to other foods (chiefly Indian meal, pollard, and separated milk), whilst Lot II. was given an extra allowance of meal mixture in place of potatoes.

The total number of pigs in each lot was 33, their average age being 13 weeks.

The average duration of the experiment was 114 days.

The total and average gains in live weight made by the pigs are given in the following table:—

Lot.	Number of pigs.	Total increase.	Average increase.	Average daily increase.
		cwt. lb.	cwt. lb.	lb.
I. Potatoes	33	47 50	1 49	1·41
II. No potatoes	33	47 97	1 50	1·42

The cost of production (food only) was:—

Lot I. Potatoes.......... ... . £1 8*s.* 2*d.* per cwt. live weight.
Lot II. No potatoes ...... : ... £1 6*s.* 7*d.* " "

Conclusions.—The results of the experiments tend to show that:—(1) Pigs can be fattened successfully without potatoes. (2) The question as to whether potatoes should be fed to pigs depends largely upon the current prices of potatoes and meals respectively. (3) It is very doubtful whether it is economical to feed pigs on saleable potatoes if they can be sold for one-fourth the value of meal, in addition to the cost of marketing.

II. *Barley Meal versus Maize Meal.*—This experiment was conducted at ten centres; the pigs, whose average age was 13½ weeks, were divided into two equal lots. The experiment lasted 92 days. The basal ration consisted in each case of swedes, potatoes, ground linseed cake, and separated milk, in addition to which Lot I. received a certain quantity of barley meal, whilst Lot II. received the same quantity of maize meal.

The total and average gains in live weight made by the pigs are summarised below:—

Lot.	Number of pigs.	Total increase.	Average increase.	Average daily increase.
		cwt. lb.	cwt. lb	lb.
I. Barley meal ...	37	47 15	1 31	1·55
II. Maize meal	37	45 62	1 26	1·50

The cost of production (food only) was found to be:—

Lot I. Barley meal ... .. £1 5*s*. 2*d*. per cwt. live weight.
Lot II. Maize meal .... £1 5*s*. 0*d*. ,, ,,

The conclusions drawn were:—(1) The results indicate that maize meal is worth approximately 10*s*. per ton more than barley meal for pig feeding. (2) As regards the quality of the pork, barley meal seems to be slightly superior to maize meal.

DAIRYING.

The Micro-flora of Stilton Cheese (*Journ. of Agric. Sci., vol. v., part 2, March,* 1913; *J. Percival and Miss G. Heather Mason, University College, Reading*).—Like all choice dairy products, Stilton cheese is exceedingly difficult to manufacture of uniformly good quality. The high moisture content favours the rapid growth of harmful as well as useful organisms, and "off flavour," objectionable taints, and irregular consistence due to the activity of the former class are common. The authors of this paper consequently began, some five years ago, the study of the micro-flora of Stilton cheese, in the hope that a more complete knowledge of the organisms present would assist in the elucidation of the ripening process, and be a step towards placing the manufacture of cheese of fine quality on a sound basis. The present report gives an account of the work already accomplished, although much remains to be done. It is found that at first there is an extraordinary development of organisms, and the numbers of bacteria and fungi in a newly-made Stilton may rise to the enormous number of 1,000 to 3,000 millions per gram ($\frac{1}{28}$ oz.) in the first 48

hours. The numbers reach a maximum within four days and decline afterwards up to the time of ripeness (100 to 150 days old), when 50 to 100 millions only are found.

In the early stages lactic acid bacteria are most abundant (*Streptococcus lacticus*) and a short, rod-shaped form of *B. acidi lactici* is invariably present. In fully ripe cheeses, however, lactic acid organisms are comparatively few in number; many die off altogether in the ripening process, and those that remain possess diminished vitality. Another organism found in all the Stilton cheeses examined is a species of *Tyrothrix*. It is found in all stages of ripening after the third or fourth day, but is never abundant.

Two fungi are of great importance in the ripening process—*Penicillium glaucum*, which rarely occurs on plates inoculated from cheeses less than three weeks old—and a yeast, a form of *Torula*, which is abundant in cheeses of all ages. The characteristic blue veins in a well-made ripe Stilton are crevices which appear in the shrinking cheese, which are more or less filled with the mycelium and conidiophores of the former fungus.

A large-celled form of the bacterium, *Streptococcus lacticus*, is found in some cheeses, and appears to be identical with the coccus present in most of the commercial starters so commonly used by butter-makers and some makers of cheese. Stiltons containing it are of fair mild flavour, but too dry and acid. The authors consider that vigorous acid formers, like this species, may be useful in repressing the objectionable organisms found in dirty dairies, or where cheese is made from doubtfully clean milk, but feel convinced that they should find no place in a Stilton dairy where cheeses of the finest flavour and texture are desired.

Manufacture of Cheddar Cheese from Pasteurised Milk (*Wisconsin Agric. Expt. Sta., Research Bull. 27; J. L. Sammis and A. T. Bruhn*).—The problem that it was desired to solve by these experiments was twofold. In the factory or creamery system of cheese-making, milk is of necessity drawn from farms spread over a large area, and the milk received is liable to be of variable quality and to arrive from different distances in a varying condition. In addition, it has been shown that the bacilli of tuberculosis retain their virulence in cheese into which they may be introduced through the milk for a considerable time. The remedy that has been proposed for both these drawbacks is the general pasteurisation of milk to be used for making cheese. Difficulty is met with, however, in making cheese from pasteurised milk—the heated milk coagulates poorly with rennet, and the curd when obtained does not expel moisture precisely as a raw milk curd does, this effect being more marked the higher the temperature of pasteurisation. The quality and behaviour of pasteurised milk curd suggest that it lacks the acid which is normally produced by the action of bacteria on milk sugar. In this investigation, lasting from 1905 to 1911, it has been found that the difficulty of poor coagulation can be overcome by adding calcium chloride solution to the pasteurised milk, but the second difficulty is not obviated, and the method is not now recommended.

Both difficulties are, however, overcome by adding an acid, preferably hydrochloric acid, to the pasteurised milk. It is stated in the

report that hydrochloric acid is normally present in the human stomach during the process of digestion in larger proportion than that added to milk in this process of cheese-making. Further, 95 per cent. of the added acid passes out of the cheese into the whey, so that no objection can be made on grounds of public health to the use of this acid in the manner described. In the process which has been evolved for American factory use the acidulation of the milk is accomplished without difficulty or danger of curdling, by running a small stream of the acid, of normal strength, into the cooled milk as it flows from the continuous pasteuriser into the cheese vat. One pound of normal strength acid is sufficient to raise 100 lb. of milk from 0·16 per cent. to 0·25 per cent. acidity, calculated as per cent. of lactic acid. The amount of acid needed each day is calculated in a simple manner described. After the milk is pasteurised and acidulated, 0·75 per cent. of first-class starter is added, and the vat is heated to 85° F. It is set with rennet, using 2 oz. of rennet per thousand pounds of milk, so that the milk begins to curdle in seven minutes.

The new process is to be given a thorough trial in cheese factories in various localities. (See also p. 281 of this issue of the *Journal*.)

POULTRY.

The Utility Poultry Club's Twelve Months' Laying Competition.—The eighth period of four weeks of the competition ended on May 27th. During May there was again a decrease in the number of eggs laid, the total being 9,520 as compared with 10,684 in the preceding month. Broodiness was still very prevalent, and was no doubt responsible for this falling off.

The premier position in May was taken by Pen 60, White Wyandottes, which at last gained the lead in spite of one bird being broody. Its record up to May 27th was 840 eggs (value £4 5*s.* 9½*d.*). Pen 86, Buff Rocks, which dropped to second position, did not by any means maintain its standard of laying. Broodiness did not claim any of the birds, so that its loss of position was due to a general falling off. Its record was 785 eggs (value £4 5*s.* 7*d.*). Pen 32, White Wyandottes, retained third position, with a total score of 791 eggs (value £3 18*s.* 2*d.*). The fourth position was held by Pen 45, White Wyandottes, which laid a total of 729 eggs (value £3 12*s.* 9*d.*). This pen will have to make considerable headway before it is able to gain an improved position. Fifth place, which in April was held by Pen 24, Black Leghorns, was, in May, taken by Pen 35, White Wyandottes, with a total of 738 eggs (value £3 11*s.* 6½*d.*). This pen rose from seventh place to fifth. Pen 24, Black Leghorns, followed with a total score of 706 eggs (value £3 11*s.* 5¾*d.*).

The only pen of Red Sussex held a creditable position, viz., sixteenth. This is probably the first occasion in a competition where this breed has done so well. The highest pen record for the month was again made by Pen 62, Silver Laced Wyandottes, which laid 131 eggs (value 10*s.* 0½*d.*).

Health continued good, and the general appearance of the birds was satisfactory.

NOTES ON CO-OPERATION AND SMALL HOLDINGS.

The Oldest Cattle Insurance Society.

The Farmers' United Cow Club, in Mawdesley, near Ormskirk, in Lancashire, is of especial interest, as it is the oldest registered co-operative society for the insurance of cattle in England and Wales. It was started in the year 1807, and has thus been at work for over a century. Its first rules were registered in 1817 at the General Quarter Sessions of the Peace at Wigan. In 1846 they were amended, and on production of a certificate signed by John Todd Pratt, the barrister-at-law appointed to certify the rules of savings banks, to the effect that they were in conformity with law and with the provisions of the Friendly Societies Acts, 10 Geo. IV. c. 56, and 4 and 5 William IV. c. 40, were allowed and confirmed at the General Quarter Sessions of the Peace held at Preston in that year. In 1878 a further amendment of the rules was registered under the Friendly Societies Act, 1875, by the Registrar of Friendly Societies. The existing rules, however, are in most respects worded similarly to those first registered nearly a hundred years ago.

The Society now consists of 18 members and insures 33 cows. A member pays an entrance fee of 6*d.* per cow and a premium of 1*s.* 6*d.* per cow per quarter—that is, at the rate of 6*s.* per annum. In return for this the Society undertakes to pay him £10 for every cow that shall die by illness or accident, and, unlike most societies, it provides that the hide and the tallow shall belong to the owner of the animal and not to the Society. Young cows not less than one year old are admitted into the club on payment of the ordinary premium, but if such animals die within a year of entry the club only pays the amount at which they were valued on admission. It is laid down that "when a cow shall die and there is not sufficient in the box to make good the loss according to the articles, then all the members of the Society shall subscribe according to the number of cows each member has entered to make up the sum of £10, let the sum or subscription money be what it will, as the occasion may require." The marker, who has to pass cows as sound and free from disease, is paid 6*d.* by the owner of every cow he marks.

The financial history of the club for the last ten years has been as follows:—The number of members has fallen from 41 to 18, and the number of cows insured from 86 to 33; adding the figures together for the ten years, the total number of animals insured has been 584, and the total number of losses 27. The amount paid on claims has been £206, which gives an average loss of 7*s.* 1*d.* per animal insured. The total income has been £244, or an average of 8*s.* 4*d.* per animal insured, and the amount now in hand as a reserve against exceptionally bad years is £37, or more than £1 per animal insured. The Society is therefore in a fairly sound financial position. Its average annual charge to members of 8*s.* 4*d.* per cow is, however, double that charged on the average by the twenty-two registered cow insurance societies in England and Wales, the chief reason for this comparatively high charge being that the death-rate for insured cows at Mawdesley has

for the last ten years averaged 4·6 per cent. per annum, against the general average of 2·4 per cent. for those societies taken together.

The recent decrease in the number of members and of cows insured is ascribed to the fact that the cottagers are giving up keeping cows, as they find they do not pay; but it is to be hoped that this Society, which must have conferred great benefits on its members for more than a century, will be able to continue its useful existence.

West Staffordshire Shire Horse Society.

This Society was founded about 1898, its object being "to encourage the breeding of Shire horses by hiring one or more Shire stallions to travel in the district, as may be arranged by the Committee." The subscription for membership is 5*s*., payable on January 1st yearly. The stallion is selected by a deputation, chosen from among the members at a general meeting. He must be over four years old at the commencement of the season, must be entered in the Shire Horse Society's Stud-book, must be certified by a veterinary surgeon to be free from hereditary unsoundness, and the Committee must be satisfied that he left at least 50 per cent. of foals as the result of his previous season. The travelling period begins early in April and closes about the middle of July. The stallion travels and stands in the district at the owner's risk and expense, the routes being fixed by the Committee; and if he is unable to finish his season, the owner must find a substitute to their satisfaction. The amount to be paid by the Society for the hiring of the horse is determined by agreement between the Committee and the owner, half to be paid at the end of the travelling season and the balance in the first week of September, and the Committee fix the nomination fee according to the amount payable for the hire. The first claim on nominations is reserved for those members who give guarantees to take them up prior to the hiring of the stallion. Mares served must be the *bonâ fide* property of the members, and the Committee have the right to decline any mares that may be deemed unsuitable. They can also substitute another horse in the event of need through any cause, or when required, and are not responsible for any damage or loss that may occur through accident, delay, or in any other way. If the groom allows the stallion to serve a mare for which he has not received a proper nomination card, the owner of the stallion is liable to a penalty of £10 per mare, to be deducted from the hiring fee.

On the average of the last four years, ending September 7th, 1912, the Society has consisted of 117 members, paying an annual subscription of 5*s*. each, and the number of nominations taken out has averaged 95 (varying from 102 in one year to 81 in another). The annual expenditure has averaged as follows:—

Hire of horse	£338
Selection expenses	8
Secretary's honorarium	10
Loss on show	9
Miscellaneous expenditure	16
Total expenditure	£381

WEST STAFFORDSHIRE SHIRE HORSE SOCIETY.

I.

Year.	No. of Members paying 5*s.* subscription.	No. of Nominations.	Nomination Fees.	Receipts. Ordinary Members' Subscriptions.	Nomination Fees.	Bank Interest.	Honorary Members' Subscriptions.	Moneys received from Guarantors.	Total Income.
			£ *s.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
1909 ...	132	102	3 3	33 0 0	321 6 0	1 8 1	99 3 0	—	454 17 1
1910 ..	115	94	4 4	28 15 0	394 16 0	16 10	75 3 0	22 0 0	521 10 10
1911 ...	112	102	4 0 and 3 3	28 0 0	333 4 0	2 9 4	75 3 0	—	438 16 4
1912 ..	110	81	3 5	27 10 0	263 5 0	2 13 4	50 2 0	—	343 10 4
Totals ..	469	379		117 5 0	1,312 11 0	7 7 7	299 11 0	22 0 0	1,758 14 7
Averages...	117	95		29 6 3	328 2 9	1 16 11	74 17 9	5 10 0	439 13 8

II.

Year.	Expenditure. Hire of Horse.	Selection and Secretary's Expenses.	Secretary's Honorarium.	Loss on Show.	Miscellaneous Expenses.	Total Expenditure.	Profit or Loss. + or −	Balance in Hand.
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
1909 ...	275 0 0	8 16 2	10 0 0	11 7 9	18 3 11	323 7 10	+ 131 9 3	165 18 3
1910 ...	400 0 0	6 0 3	10 0 0	8 9 8	16 1 9	440 11 8	+ 80 19 2	246 17 5
1911 .	350 0 0	5 0 6	10 0 0	10 4 8	15 6 11	390 12 1	+ 48 4 3	295 1 8
1912 ...	325 0 0	13 8 9	10 0 0	6 17 7	15 14 10	371 1 2	− 27 10 10	267 10 10
Totals .	1,350 0 0	33 5 8	40 0 0	36 19 8	65 7 5	1,525 12 9	+ 233 1 10	—
Averages ..	337 10 0	8 6 5	10 0 0	9 4 11	16 6 10	381 8 2	+ 58 5 6	—

and the average annual income has been:—

Ordinary members' subscriptions	£ 29
Nomination fees	328
Bank interest	2
Received from honorary members and guarantors ...	80
Total income	£439

so that the net profit of the Society's working has averaged £58 per annum, and the balance in hand has increased during the four years by £233 from £34 to £267. During the first three years there was a substantial profit, but during the last year there was a loss on working of £28, due mainly to the fact that the number of nominations paid for in that year was only 81, against a previous average of 99. If 99 nominations had been paid for last year, the loss of £28 would have been converted into a profit of £30.

The amount paid for the hire of the horse, which varied from £275 to £400, averaged £338, and the nomination fee, which the Committee fixes each season according to the amount paid for hire, varied from £3 3*s*. to £4 4*s*., the amount actually received during the four years averaging £3 9*s*. per nomination, which equals a small fraction over 1 per cent. on the amount paid for hire. The market price of the horses selected is estimated at between £600 and £1,000.

For the present season (1913) the Society has hired "Slipton King" (26,692), foaled in 1907, for £682 10*s*., and has fixed the fee to be prepaid by members at £6 6*s*. per mare. The full number of nominations agreed upon with the owner, viz., 90, has been applied for at this rate.

Had not the Society received on the average £80 per annum from honorary members and guarantors, its accounts for the four years would have shown an average loss of £22 instead of an average gain of £58. The expenses of management, including the expenses of the Selection Committee, secretary's honorarium, printing, stationery, stamps, and loss on Show, came to an average of £43, which would have been more than covered by the ordinary subscriptions if they had been 10*s*. instead of 5*s*.; and the only other expenditure, the hire of the horse, would have been covered by the nomination fees had they been fixed at £1 1*s*. per cent. on the amount paid for the hire of the horse. That is to say, provided that the Society could have reckoned on an average of at least 100 members and 95 nominations, it would have more than supported itself, and would not have required any subscriptions from honorary members and guarantors if it had fixed the ordinary member's subscription at 10*s*. per annum, and had charged a nomination fee of not less than £1 1*s*. per cent. on the amount paid for hire of the horse.

It is reported that the percentage of foals left has been satisfactory, and that a great improvement is noticeable in the number and quality of the Shire stock owned by the breeders of the district.

The Claverdon and District Pig Assurance Society.

This Society is confined to persons living in Claverdon and surrounding villages in Warwickshire, its object being "to assure against the loss of pigs by death, disease, or otherwise." Each member pays an entrance fee of 6*d*. on joining the Society, and an additional entrance fee of 6*d*. for each pig he insures. He is also liable to pay a subscription of 3*d*. per quarter for each pig. The insurance fee covers the risk only of the particular pig insured, and the Society's liability cannot be transferred to any other pig.

At the end of 1912 there were 38 members, who insured 39 pigs. During the last eleven years the Society insured altogether 458 pigs, of which 21 died, so that the average death-rate was 4·6 per cent. per annum, which is slightly above the average death-rate of 4·2 per cent. for the registered pig clubs in England and Wales. It paid altogether as compensation on pigs that died £55, an average of £2 12*s*. per animal that died and of 2*s*. 5*d*. per animal insured; but it received £37 from sale of carcasses, so that the net loss to the Society during the eleven years under this head was £18, an average of only 18*s*. per animal that died and of only 9*d*. per animal insured. The management expenses amounted to £6, so that the total expenditure during the eleven years was £61. The Society received in entrance fees and subscriptions £20, or an average of 10½*d*. per animal insured. Besides this, there was an income from sale of carcasses of £37, and from interest of £8, so that the total income during the eleven years was £65, and there was a net profit to the Society during that period of £4. The amount of the reserve fund at the end of 1912 was £31.

At the annual meeting, when the state of the funds allows, the Society passes a resolution exempting members of a certain standing from the payment of quarterly subscriptions for the coming year; and under this excellent plan, during seven of the eleven years, old members were able to insure their pigs for a total payment of 6*d*. per pig per annum; and even new members had to pay only 1*s*. 6*d*. per pig per annum.

This little society of cottagers has thus by good management been able to insure its members' pigs at an extraordinarily low rate. It owes much to the village schoolmaster, who started it twenty-two years ago, and is still its honorary secretary.

Co-operative Purchase and Use of Bulls in Denmark.*

Associations for the co-operative purchase and use of bulls in Denmark date from 1874, in which year the first cattle breeders' association was formed in Jutland. A second association was formed in 1881, but the increase in the number was slow until 1887, after which rapid progress took place in all parts of the country. There are now more than 1,300 associations of cattle breeders in Denmark, with over 1,500 really good bulls.

It should be explained at the outset that the work of the associations

* From a report by His Majesty's Chargé d'Affaires at Copenhagen, and *United States Bureau of Animal Industry*, Bull. 129.

is not solely for the purpose of obtaining, at a low cost to the members, the use of a good bull, but is also directed to improving the quality of the herds, and as such has been fostered by the Government, many of the schemes of the latter for the improvement of the live stock industry of the country having been built on the work of the associations.

The associations are local, and their membership varies from four to sixty, the average being about twenty-four. One or more bulls of recognised breeding may be purchased, the purchase being usually made with borrowed money, which is paid off after a period of four years, this time being the bull's average period of utility. As the members of the association generally own more cows than their bull or bulls can serve, a local judging committee is appointed, which, together with an expert employed by the "joint management" of several associations in common, visits each member and selects a number of cows worthy to be bred to the association bulls, in proportion to the size of his herd and the total number of cows in the association.

The bull is, as a rule, stationed with the member who submits the lowest bid for keeping him, the price varying from about £10 to £19 per annum.

Assuming that the bull costs £56 (an average price), that its serving capacity is four years, that its sale value is £24, that the members of the association own eighty cows with a service fee of 4*s.* 3*d.*, and that the bull is awarded a prize at each of the yearly shows, a typical balance-sheet of an association would be as follows:—

Income.	£	s.	d.	*Expenditure.*	£	s.	d.
State subsidy...	5	10	0	Yearly instalment on purchase price	14	0	0
Proportion of sale value	6	0	0	Interest	1	0	0
Prize at Annual Cattle Show	3	10	0	Fodder and keep (average)	13	5	0
Service fees from eighty cows at 4*s.* 3*d.*	17	0	0	Veterinary Surgeon's fee...	0	10	0
				Insurance	1	5	0
				Show Expenses	1	5	0
				Contribution to the "joint management"	0	15	0
	£32	0	0		£32	0	0

The insurance mentioned in this statement is usually made with a special co-operative insurance company, and protects the association from losses which might be incurred by accident, sickness, or death of the bull. As regards the yearly instalment of the purchase price, the individual members are responsible for the payment of this in proportion to the number of cows each has registered in the association. The effect of the association being started with borrowed money is that it is possible for farmers with small means to participate.

The State subsidy (averaged above as £5 10*s.*) may amount to as much as £8 per annum for each bull. The grant is given on condition that the bull is examined by a veterinary surgeon twice every year; that the best cows of the members are selected by the Committee to be served by the bull; and that the Committee at least once a year inspects all the herd in the association in relation to their health. Further, the bull must have received a premium or "recognition money" at a Government show, or at a breeding association show supported by the Government. It should be explained that a large

amount of money is set aside by the Government for premiums at shows. The "recognition money" is money distributed in respect of bulls which do not receive premiums, but which are considered worthy of recognition as good bulls. A bull to be eligible for Government aid must, furthermore, win a premium every year at a breeding association show until such time as his offspring receive premiums, or, after having reached the age of three years, he must at least be found worthy of a premium at a Government show. No aid is granted before the bull reaches the age of 1½ years, and then only as long as he is in possession of his full breeding capacity. In case a bull is sold, the Government aid can be retained if the association, within two months after the sale, buys another bull meeting the above-named requirements. A complete report from the association is required by the Government at the end of each year.

The extent to which this Government aid benefits the associations will be evident from the typical association balance-sheet quoted above. In the absence of the State subsidy and the show premium, the service fee would have to be raised to over 6*s*. per cow. It must not be thought, however, that all the associations receive Government aid. There were, in 1906, thirty co-operative breeding associations which did not receive Government aid, and were consequently not subjected to Government supervision. Additional aid may be obtained by the association both for special work in developing good families and for keeping records of the yield of milk and butter-fat and the food consumed by individual cows in the herd.

The following extracts from by-laws of cattle breeders' associations under common management on the Island of Funen may be given as typical of the rules under which these associations work:—

"The aim of the cattle breeders' association is to produce the sure and rapid development of a sound, well-built, productive Red Danish breed of milch cows. The aim shall be reached principally by the purchase of meritorious herd bulls, by selecting the best dams (the selection being, as much as possible, based on information about yielding capacity and pedigree), by a rational treatment of the offspring, and by the holding of local shows.

"Every cattle breeder within the district is eligible to membership who subscribes to these by-laws and has in his herd at least one cow which is considered by the management of the association to be worthy of joining the ranks of the breeding animals.

"The management of the association shall be vested in a Board of Directors. . . . The Board shall direct, purchase, offer for service, exclude, and sell the herd bulls of the association, select the cows of the members, act as judges at the local shows, and give members advice regarding their book-keeping. . . . The Board of Directors or a Committee of the members shall, once a year, inspect the herds of the members on their farms.

"The herd bull must be sound and well-built, of Red Danish milking breed, and recognised good pedigree. He shall be insured, and twice a year shall be examined by a veterinary surgeon. He should not be utilised for breeding purposes until he reaches the age of 1½ years. When purchasing bulls, the association should secure guarantee of breeding capacity. The bull shall be exhibited every year until he

shall have received premiums on account of his offspring. Until the age of three years he shall be exhibited at a breeding association show subsidised by the Government; and after the age of three years at the Government show. He shall also be exhibited at the local shows.

"The members are entitled to have their cows served by the association bull, provided that the cows are not subject to abortion, are otherwise healthy, and are approved by the Board of Directors.

"The fee for service shall be determined every year by the Board of Directors, and shall be paid by the members in proportion to the number of their eligible cows.

"Every member must keep the records directed by the Board of Directors, and is bound to exhibit, at the local shows arranged by the Board of Directors, all selected cows and their offspring by the association bull until the heifer becomes pregnant for the first time and the bulls reach the age of two years. Calves less than three months old need not be exhibited. Each calf shall be earmarked with the number of its dam, according to a method adopted by the management.

"The members shall be bound, on the demand of the Board of Directors, to exhibit the offspring of the association bull, if such are in existence, at the annual offspring shows preceding the Government shows.

"The cows shall be selected and a record kept in the selection book. Only healthy animals shall be admitted."

Small Holdings and Allotments Societies in 1911.

Particulars relating to the operations, during 1911, of land societies registered under the Industrial and Provident Societies Act, 1893, are given in the Report of the Chief Registrar of Friendly Societies for 1911 [H.C. 123-xiv., Part B]. These societies are divided into (*a*) societies comprising the ordinary land purchase societies, and (*b*) small holdings and allotments societies, the former comprising societies purchasing and owning land for resale to members, principally for residential purposes, and the latter those for the acquisition of land for the promotion of small holdings and allotments, either under the Industrial and Provident Societies Act alone, or in conjunction with the Small Holdings and Allotments Act.

The returns of 196 small holdings and allotments societies in England and Wales at the end of 1911 show an aggregate membership of 13,144. The productive expenses amounted to £154, and distributive expenses to £980. The balances of the trading departments resulted in 29 societies in a profit of £430, and in 11 societies in a loss of £237. In their small holdings and allotments departments rent was received amounting to £19,369, and other income to £2,368. The disbursements for rent, rates, and taxes amounted to £16,824, management expenses to £2,370, the balance of the operations being in 41 societies a profit of £882, and in 32 societies a loss of £553. In this respect it should be borne in mind that the formation expenses of newly established societies, such as those under consideration, are necessarily heavy in the earlier years of existence, while the sources of revenue are undeveloped.

The share capital of members of small holdings and allotments societies in England and Wales amounted to £10,769, and loan capital and

other liabilities to £6,853. The aggregate balances of profit and reserve carried forward in 57 societies amounted to £2,164. Stock in trade amounted to £547, while buildings, fixtures, and land owned by the societies and employed in their operations were valued at £4,534. Investments and other assets were valued at £13,383. In 91 societies the aggregate balance deficit amounted to £1,322.

It appears from the returns giving the information that 8,952 acres have been acquired as small holdings at an annual value of £13,480; allotments comprise an area of 1,172 acres at an annual value of £2,762, while grazing and other rights over 229 acres are valued at £105 per annum. The number of tenants occupying the foregoing land was returned at 8,142.

The following table compares various particulars in the returns received for 1911 with those for 1910.

Year.	No. of Societies Making Returns.	Membership.	Rent Received.	Area of I and Acquired by End of Year.	Annual Value of Land.
			£	Acres.	£
1910	163	10,241	14,233	8,505	13,975
1911	196	13,144	19,369	10,353	16,347

A Successful Fruit and Flower Holding of Seven Acres.

Among the instances of successfully conducted small holdings given in the annual report of the Board of Agriculture and Fisheries for 1912 on Small Holdings [Cd. 6770] is the following description of a fruit and flower holding of seven acres:—

The tenant in this case began with one rood of land and he has now seven acres, of which three acres are leased from the County Council. One acre was taken from the Council at Michaelmas, 1908, at a rent of £3 5*s*., and the other two acres were taken from Michaelmas, 1912, at a rent of £3 10*s*. per acre. The tenant pays, therefore, a rent of £10 5*s*. for his holding under the Act comprising three acres without buildings, but as he had previously to rent small pieces of land at £5 5*s*. an acre, he is well content.

The land which was first hired from the Council was part of a 21-acre field which they purchased in 1908 for £50 an acre. It was then a piece of stubble in bad condition, but the present tenant has devoted it mainly to fruit and flower growing. The crops grown thereon in 1912 consisted of asparagus, apple stocks, plums, raspberries, strawberries, and gooseberries, and the following flowers, viz., marguerite daisies, Spanish iris, asters, Michaelmas daisies, and pyrethrums. Prior to Michaelmas, 1912, the holding of 5½ acres afforded employment for the tenant, his son, and one other man, and provided them with their whole living. The flowers are grown between bush fruit, and the tenant estimates that they produce a profit of £50 an acre. They are mostly sold as cut flowers in Manchester and Sheffield, and the tenant also sells plants and apple stocks to other growers, and makes a speciality of mint.

The tenant has also a good-sized glasshouse in his home garden. He grows chrysanthemums and tomatoes with a crop of mint between

the two. This year (1912) he cleared out his chrysanthemums before Christmas, and on Boxing Day planted the whole ground space with mint, which was nearly ready for picking on January 20th. It will make way for tomatoes. The glasshouse is heated by a central overhead flow pipe, the return pipes being laid on the ground level round the two sides. This arrangement saves the necessity of putting the boiler in a pit, and secures a more rapid circulation and more even heat throughout.

A remarkable feature in the development of fruit and flower growing in this village is the rapid rise in the land values. In 1908 the Council bought land for small holdings at £50 an acre. In 1912 the adjoining field was sold by auction in 2-acre plots. The two plots next the Council's small holdings realised £130 and £125 per acre respectively. The whole field averaged £112 per acre. It is let until Michaelmas, 1913, to a farmer at 30*s*. an acre rent, and it is now planted with wheat. The purchasers were small men who in several cases have risen from agricultural labourers, and will themselves occupy the land. An allotment field, let at £4 an acre, sold at the same sale for £106 an acre to a purchaser who requires it for fruit-growing, probably raspberries. The County Council purchased 71 acres at the same sale, of which 35 acres of land suitable for fruit-growing averaged £71 per acre. This land was let for farming at 30*s*. per acre, and is now let by the Council in small holdings at £3 10*s*. per acre. The development of fruit and flower growing in this village is chiefly the work of small holders, and has been much stimulated by the Small Holdings Act.

In 1908 there were already 165 small holders in the parish. Applications were received by the Council from 74 persons for 216 acres, and applicants for 205 acres were approved. The Council have let 163 acres which they acquired by purchase, and at the date of the report there was still an unsatisfied demand from 71 persons for 171 acres.

Small Holdings in Sweden*

The recent movement for the increase and better cultivation of small holdings in Sweden is so interesting, and so carefully thought out, that a short account of its origin and the lines on which it has proceeded may not be out of place. As a preliminary to this, however, it may be well to emphasise one or two points of difference in the conditions surrounding the problem as compared with those under which the similar movement is proceeding in this country.

In the first place, it must be remembered that not only is Sweden far more typically a country of small holdings than our own, but also the proportion of the population that is accustomed to the traditions and habits of rural life is relatively very much larger. Over 40 per cent. of the total population of 5½ millions are actually engaged in agriculture, while not more than 24 per cent. live in the towns. This makes the problem of establishing small holdings to a certain extent an easier one than with us.

Again, the price of agricultural land appears to be lower than that ordinarily paid for similar land in this country. The difference in price does not seem to be wholly explained by a difference in the quality of the soil, or in the facilities for disposing of produce, and it seems

* From the Report (Cd. 6708, price 11*s*. 3*d*, now published at 1*s* 6*d*.) of the Departmental Committee on Buildings for Small Holdings.

probable, therefore, that the Swedish smallholder is placed, from the outset, in a rather more favourable position to pay his way than the Englishman, though the relative prices obtained for agricultural produce also have an important bearing on the question. Comparison of the actual financial position of the smallholder in the two countries is somewhat difficult owing to the fact that the Swedish policy, being naturally in keeping with the prevalent system of occupying ownership, aims at the creation of new freeholds; indeed, there is little, if any, demand for tenancies. One important result of the smallholder being the owner is that he is made responsible for the repair and upkeep of the buildings which, to a considerable extent, he also assists in providing.

The Provision of Small Holdings in Sweden.

The Swedish movement for the creation of small holdings began in 1905, after the Diet of 1904 had granted the money and fixed the conditions for obtaining loans. During the last four years, an annual sum of 5 million crowns (£278,000) has been set aside for the development of small holdings, and for the year 1913 the amount has been increased to 7½ million crowns (£417,000). Loans are granted from this fund to intending purchasers of small holdings up to five-sixths of the value of the property. The maximum value of the property, including land, house, and farm buildings, was fixed originally at 5,000 crowns (£278), but it has been since raised to 7,000 crowns (£390) for holdings already equipped, and 8,000 crowns (£444) for holdings requiring equipment. The object of raising the maximum was to increase the number of smallholders making their entire livelihood from their holdings, the average area of land previously obtained by means of State loans being, as a rule, insufficient for this purpose. The average amount of land hitherto provided has been from 5 to 20 acres of cultivable land, supplemented in some instances by an area of woodland. The acreage of land upon which a man can make his living varies, of course, but is estimated at from 12 to 24 acres, under ordinary methods of cultivation, according to the part of the country; though there are certain districts where a smaller area will suffice, it may be noted that in Sweden, as in Denmark, there is a growing feeling in favour of a somewhat larger size of small holding than that obtaining hitherto.

The terms upon which loans are granted from State funds are as follows:—

Interest is charged at the rate of 3·6 per cent. on the amount of loan outstanding. For the first three years no repayment of capital is required; from the fourth year inclusive the loan is divided into two equal parts, one of which is liquidated by an annuity of 6 per cent. (including interest at the rate mentioned), while on the other half interest alone is paid until repayment of the first half is completed, which occurs in about twenty-nine years from the date of the loan being granted. Upon completion of repayment of the first half of the loan, the remaining half is required to be paid off within five years. Thus, for every £100 of loan, the amount paid by the borrower would be £3 12*s.* for the first three years, £4 16*s.* for the next twenty-six years (*i.e.*, £6 per cent. on £50, and £3·6 per cent. on £50), and

£11 2s. for the next five years, this last amount being the annuity required to pay off the balance of £50.

Loans from State funds are not granted directly to individual purchasers, but to associations or companies, whether national, provincial, or local, which are precluded from charging a higher rate of interest than that paid by them, their expenses being met by a subvention equal to one-half per cent. on the amount of their loan issue. Some of these associations grant supplementary loans from their own funds.

During the period from 1905 to 1911 about 6,220 purchasers of small holdings were financed by means of State loans to the amount of nearly one million pounds sterling. The majority of those assisted were agricultural labourers occupying small pieces of land of which they have been enabled to become the freeholders. Some holdings, however, have been newly created by taking land from larger properties and equipping it with houses and buildings, thus providing entirely new small holdings. New dwelling-houses have been erected on nearly 2,000 of the small holdings established.*

Besides the fund available for advances of this nature, the Government has also set aside a special fund of two million crowns (£111,000), out of which money is advanced to freehold companies and associations for the purchase and subdivision of properties suitable for small holdings. Loans to these companies are limited to four-fifths of the value of the property, bear interest at 4 per cent., and must be repaid within five years from the sale of the lots. Of late years much has been effected by means of the purchase and dividing up of large and well-situated properties. This work is carried out partly by associations and partly by private business men; the latter are not always actuated by disinterested motives, and consequently colonies established in this way often prove far from satisfactory.

In order to counteract unhealthy speculation and to augment the supply of land available for small farms in different parts of the country, the National Association against Emigration was founded in 1907. One of the principal objects of this organisation is to afford the young agriculturist a chance of earning his living in his native land, and thus to check the emigration of the agricultural population.† The Association acts as a parent society, and has founded several freehold companies which, working under its direction, buy properties, cut them up, and create as far as possible well-arranged freehold colonies. The first company was formed in Varmland in the spring of 1908, and there are now nine such companies, of which the Bankesta Small Holdings Company is one of the largest.

Speaking generally, the work, although still in its experimental stage, has been successful, and most of the companies have been able to pay full interest on their capital, which is limited to 6 per cent. per annum. The National Association has been the means of establishing up to the present time about 280 new freeholds, mostly

* In England and Wales, up to the end of 1912, 569 dwelling-houses have been newly erected by County Councils and County Boroughs under the Small Holdings and Allotments Act, 1908.

† The town population has increased in 40 years from 540,000 to 1,367,000, or nearly five times as fast as that of the kingdom as a whole. The number of emigrants averages 20,000—25,000 per annum.

through the agency of the companies it has started, but to some extent also on estates belonging to private individuals. Apart from this Association and its affiliated societies, there are other freehold companies and associations, such as the Malmö "Own Homes' Association," which has done very good work in the province of Skania in South Sweden.

Instruction and Assistance for Smallholders.

It is fully recognised in Sweden that the placing of men on the land is but the first step, and that it is of great importance that they should receive instruction and guidance in the subsequent management of their holdings. The measures taken by the State to supply this need, of course, are not limited to those occupiers who are assisted to obtain land by means of State funds, but are part of a scheme for encouraging improved methods in the cultivation of small holdings generally. A very important part in the administration of the laws affecting agriculture is played by the agricultural societies; most of these have been in existence for about a century, and one is generally to be found in each county. Since 1902 a number of laws have been enacted with the view of improving the cultivation of small holdings; some of the more important of the measures adopted are as follows:—

Award of Prizes to Smallholders.—Each agricultural society divides its district into two or three "Rewards" districts, and awards prizes every few years for the best kept and most productive small holding. Tenants of holdings not exceeding 30 acres are eligible for these prizes.

Tours of Instruction for Smallholders.—Men and women occupying holdings not exceeding 100 acres can take part in these tours, which are found to be conducive to improvement in the cultivation of small farms. Travelling expenses are paid by the State, and other expenses by the agricultural societies, the itinerants sometimes contributing a small sum themselves.

Instruction and Practical Tuition.—The people's high schools,* which have been in existence for nearly fifty years, provide educational facilities for farmers' children, giving agricultural instruction of a general character; and closely connected with them are the agricultural schools proper. Purely agricultural tuition for small farmers is provided by means of local courses lasting six or fourteen days. A new and simpler type of agricultural school is now being established, which is intended primarily for the sons of small farmers, those who have only passed through the elementary schools being eligible as pupils.

There are five State consulting advisers and inspectors in agriculture, one of whom devotes his whole time to small holdings. Their duty is to supervise and instruct the numerous provincial agricultural experts (agronomes), who advise smallholders throughout the country; to advise generally as to any measures that will improve and develop agriculture, and to promote the creation of associations of all kinds.

In some districts trial has been made of a system of itinerant foremen, who are given much smaller districts (comprising only one or

* "Folkshogskola"—a special type of school characteristic of Sweden, Norway, and Denmark.

two parishes) than those assigned to the local agricultural adviser. These foremen advise the small farmers in regard to the practical working of their farms; they are the servants of the provincial agricultural societies, but the State gives a grant in aid, and provides courses of instruction for their training.

The Improvement of Farmers' Homes.—Courses of lessons in cookery and domestic economy are provided, and tours of instruction for women also constitute a feature of this work. Advisers in household management have been appointed in some districts, and it seems probable that this movement will be considerably developed. Two country homesteads have been fitted up to serve as demonstration centres for the whole range of domestic work.

Encouragement of Associations.—Much importance is attached to the organisation of agricultural associations of all types, and especially to those intended for the benefit of small farmers, such as milk-control, bull, book-keeping societies, &c. The State aids in this work by providing instruction as well as by giving considerable financial assistance.

Establishment of a National Co-operative Credit Institute in Italy.

According to a report by H.M. Chargé d'Affaires at Rome, a National Co-operative Credit Institute has been established in Italy on the initiative of the Minister of Agriculture, seconded by the Director-General of the Banking Department, with the object of giving financial assistance to all co-operative bodies legally organised, and to smaller agricultural associations and peasant farmers.

The capital of the new Institute, amounting to 7,750,000 lire (£310,000), has been supplied by the various savings banks of the country, and is expected to be increased to 10,000,000 lire (£400,000). Apart from this foundation capital, the Administrative Council of the Institute are free to accept further capital from legally-constituted co-operative societies or other public bodies, provided that such sums are not less than 10,000 lire (£400). No responsibility is incurred by the bodies contributing in this manner, while on the other hand, a contribution of 10,000 lire (£400) gives the contributor a right to one vote in the General Assembly of the Institute.

The Institute is administered by a General Assembly and an Administrative Council, which elects, subject to the approval of the Minister of Agriculture, a Director-General, who carries on the general work of the Institute. Various technical and administrative committees are appointed to advise and assist in the work of the central and local offices of the Institute.

OFFICIAL NOTICES AND CIRCULARS.

Landing of Animals from Ireland. The Board of Agriculture and Fisheries made an Order on June 12th adding Fishguard to the list of ports in Great Britain at which cattle, sheep, goats, or swine may be landed from Ireland in conformity with the provisions of the Animals (Landing from Ireland) Orders of 1913.

Report on Allotments, &c., for 1912.

Part II. of the Report of the Land Division of the Board for 1912 has been recently issued [Cd. 6832, price 3*d.*], and gives an account of the proceedings of the Board during 1912 under the Acts relating to Allotments, Universities and College Estates, Glebe Lands, Improvement of Land, Settled Land, and Agricultural Holdings.

With regard to allotments, it appears that on December 31st, 1912, the total quantity of land let for the purpose of allotments by the various Local Authorities in England and Wales was 31,089 acres, of which 7,143 acres were the property of the Councils and 23,946 acres were leased. This land is let to 117,562 individual tenants and 21 associations.

Proceedings under the Tithe, &c., Acts for 1912.

The annual report of the proceedings of the Board in 1912 under the Tithe, Copyhold, Inclosure, Commons, Land Drainage, Light Railways, and other Acts, including the business formerly transacted by the Land Commissioners for England, has been published, and may be obtained from Messrs. Wyman and Sons, Ltd. [Cd. 6833, price 2½*d.*].

Report of the Intelligence Division for 1912.

The Board have recently published Part I. of the Annual Report of their Intelligence Division for 1912 [Cd. 6872, price 5*d.*]. This part of the Report deals with the proceedings of the Board in 1912 under the Sale of Food and Drugs Acts, the Fertilisers and Feeding Stuffs Act, the Merchandise Marks Acts, and other Acts. Appendices to the Report contain particulars of the samples of food and drugs, milk and butter, and fertilisers and feeding stuffs taken and examined during the year. Reports are also given by Mr. Wilfrid Sadler on the necessity for, or desirability of, adding water to milk used for making clotted cream, and by Professor D. A. Gilchrist on the composition of first-drawn and last-drawn milk.

MISCELLANEOUS NOTES.

The Isle of Wight Bee Disease.

With the present issue of the *Journal* the Board publish as a Supplement * (price 4*d.* post free) a further report on the Isle of Wight Bee Disease. In this report the final results of the investigations which have been carried out on behalf of the Board of Agriculture and Fisheries by Dr. G. S. Graham-Smith, Dr. H. B. Fantham, Dr. Annie Porter, Mr. G. W. Bullamore, and Dr. W. Malden are discussed. The previous report by the same investigators was published as Supplement No. 8 to the *Journal* for May, 1912.

According to the authors of this further report, it may be stated with confidence that a protozoal parasite, *Nosema apis*, is the agent responsible for most of the outbreaks in which the symptoms of the

* This Supplement will be supplied free to subscribers to the *Journal* on written application.

Isle of Wight disease have been noticed, or in which stocks have dwindled or died without apparent cause.

Symptoms.—It is pointed out that certain symptoms, such as the inability of some of the diseased bees to fly, the presence of numerous bees on the ground in front of the hives, and the gradual dwindling of stocks, are common; but many other symptoms have been recorded, and no one symptom is characteristic of the disease. The only essential feature is the death of large numbers of bees, and often of the whole stock, especially during wet and cold periods of the year or during the winter months. It has been further shown that the disease is probably endemic, but that, owing to lack of observation, it often passes unnoticed in mild seasons, the loss of the bees being attributed to cold, starvation, spring dwindling, robbing, wax moth, diarrhœa, and other causes. It is only during severe epidemics that the disease attracts much notice. These epidemics are especially apt to make their appearance during cycles of wet and cold springs and summers, and may continue subsequently for some seasons.

Modes of Spread.—Water or moisture near hives contaminated with infected excrement appears to be the most important factor in the dissemination of the disease; nectar, pollen, or other substances collected as food may on rare occasions be infected.

Infection within the hive may occur through infected water stored in the cells, the passage of wax, &c , from bee to bee, and more especially by excrement deposited by infected queens, drones, and worker bees suffering from dysentery. Pollen and honey contaminated by excrement may also cause infection.

Infection from hive to hive and from apiary to apiary is brought about mainly by the interchange of adult infected "carriers," and to a less extent by robbing, especially when the living remnants of the weak stock join the robbers, by infected swarms entering healthy apiaries, and by the occupation of old hives. Infected "carriers" are probably most important agents in spreading the disease by infecting water or food with their fæces, as well as in keeping it in existence from season to season.

The trade in bees from infected districts helps to disseminate the disease over greater areas than would be reached by natural means.

Cold and wet weather, by affecting the health of stocks and affording opportunities for bees to gather contaminated moisture near hives, greatly influences the spread of the disease.

Other insects associated with hives of bees, such as wax-moths, wasps, and ants, and other species of bees, may at times carry the spores of the disease, and thus play some part in their dissemination.

Treatment and Prevention.—There is little evidence that treatment by any of the remedies which have been suggested results in permanent cure, though amelioration of the symptoms for a time not infrequently occurs. Prevention is therefore the only satisfactory method of controlling the disease. Healthy stocks should be removed from the neighbourhood of diseased ones, and the bees should be supplied with an easily accessible supply of clean water, which should be changed daily, and protected from contamination by flying bees. If necessary, the usual drinking places should be removed. Bees killed by the disease, frames, quilts, &c., from infected hives, should be burnt, and

the hives should be disinfected, preferably by slight charring. The ground should be turned over and treated with lime. Diseased stocks should be destroyed as soon as the condition is diagnosed, and, further, healthy bees should not be introduced into an apiary where the disease has shown itself. Driven bees and stocks from infected districts should not be imported into other districts. Finally, an endeavour should be made to build up apiaries from stocks which have escaped infection.

Importation Regulations.

Free Carriage of Pedigree Live Stock to South Africa.—The following conditions attaching to the free carriage of pedigree live stock to South Africa by the Union-Castle Steamship Company, Ltd., have been published by the Secretary for Agriculture for the Union of South Africa (Notice No. 723 of 30th April, 1913), and are given in continuation of the note on the subject which appeared in this *Journal* for December, 1912, p. 783:—

(1) The term "pedigree stock" includes stallions, mares (excluding racehorse mares), bulls, cows, boars, sows, rams and ewes for breeding purposes.

(2) The term "free of freight" includes accommodation and supervision equal to that for which freight is paid under ordinary circumstances, but not food, which will be provided by the Company at the cost of the shipper at the following scale of charges to all ports:—

For stallions and mares, bulls and cows, £4 15*s*. per head.

Boars and sows, rams and ewes, £1 7*s*. 6*d*. per head.

These charges must be paid by the shipper on booking the animals.

(3) The stock will be carried at owner's risk.

(4) Should shippers desire to provide veterinary or special attendance of freight-free stock, such can be done on special terms to be arranged with the Company.

(5) The pedigree stock must be registered in the stud, stock, or herd book of the different breed societies or other recognised public associations approved by the High Commissioner.

(6) A pedigree of each animal, signed by the breeder, and duly attested by at least one credible witness, and certified by the authority of the stud, stock, or herd book in which the animal is entered, should be attached to the application for free carriage, and produced to the Company, together with a certificate to be obtained from the High Commissioner to the effect that he approves of the stud, stock, or herd book.

(7) In the case of animals of the equine species, a certificate by a qualified veterinary surgeon must accompany the pedigree to the effect that the animal is free from hereditary disease.

(8) A veterinary inspection of all animals will be made at the instance of the Company immediately prior to shipment, and a fee of 2*s*. 6*d*. will be charged therefore in respect of each free-carriage animal.

(9) Stock imported free of freight may not be removed from the territory of the Union of South Africa during a period of not less than three years, nor may such stock be re-exported.

(10) Free carriage will not be granted by the Company for pedigree stock intended for the Bechuanaland Protectorate, Swaziland, or Basutoland until they are incorporated in the Union of South Africa.

(11) The Agricultural Department of the Union has the right to request the Company not to carry free of freight any animal or animals, even though possessing the prescribed pedigree.

It may be interesting to note that these concessions granted to the farmers of South Africa are being freely taken advantage of, and, compared with previous years, the shipments of pedigree stock during recent months have grown considerably.

At the time the contract between the South African Government and the Union-Castle Steamship Company was concluded, shipments of about 30 head of cattle per month were made, while shipments are now coming forward at the rate of 100 to 150 head of live stock per month.

Importation of Animals into Canada.—The Board have been furnished by the High Commissioner for Canada with a copy of the Animals Contagious Diseases Act, together with subsequent amendments and all regulations made thereunder. The quarantine regulations in force are those authorised by an Order in Council of November 30th, 1909, as amended by an Order in Council of August 19th, 1911. The following is a summary of these regulations in so far as they relate to animals exported from the United Kingdom:—

General.—Persons contemplating the importation of animals must (except in the case of horses) first obtain a permit therefor from the Minister of Agriculture. Applications for such permits shall be in writing, and shall state the number and kind of animals for which the permit is applied, the country of origin and probable date of shipment, the port of embarkation, the port at which the animals are to be landed, and the approximate date of their arrival.

Animals may be landed only at the ports of Victoria, Vancouver, Quebec, St. John, Halifax, and Charlottetown.

Animals imported *viâ* the United States must be accompanied not only by the necessary health certificates from the country of origin, but also by a certificate of quarantine or inspection signed by a veterinary inspector of the United States Bureau of Animal Industry.

All animals arriving in Canada shall be subject to inspection on arrival.

Animals must be accompanied by the certificate of a qualified veterinarian and of the local authority of the district whence they came to the effect that the following diseases have not existed in the district for a period of six months prior to their shipment:—In the case of *horses, mules,* and *asses,* glanders, maladie du coït, or other serious infectious or contagious disease affecting horses; in the case of *cattle,* contagious pleuro-pneumonia, rinderpest, or foot-and-mouth disease; in the case of *sheep* and *goats,* foot-and-mouth disease; in the case of *swine,* hog cholera, swine plague, or foot-and-mouth disease. The periods of quarantine are 30 days for cattle, counting from the date of arrival at the quarantine station, and 30 days for sheep and goats, and swine counting from the date of clearance of the vessel carrying the same from the port at which they were embarked.

Cattle six months old or over will not be discharged from quarantine until they have been submitted to the tuberculin test. Cattle reacting to the tuberculin test, but not showing clinical symptoms, will be permanently marked in the right ear with the letter "T," and may then

be released at the expiry of the prescribed period of quarantine if found free from all other infectious or contagious diseases. Cattle showing clinical symptoms will be destroyed or otherwise disposed of as the Minister of Agriculture may direct. The destruction of any quarantined animal may be ordered.

Free Importation of Animals for the Improvement of Stock.—According to the *Board of Trade Journal* for April 3rd, 1913, a Customs Memorandum, dated February 17th, 1913, provides that no animal imported for the improvement of stock shall be admitted free of duty unless the owner is a British subject, resident in the British Empire, or if more than one owner, each is a British subject, resident in the British Empire, and there is furnished an import certificate stating that the animal is recorded in a Canadian National Record or in a Foreign Record recognised as reliable by the National Record Committee. A statutory declaration by the owner or one of the owners is required to the above effect, and also that such animal is the identical animal described in such certificate, and that the animal is being imported into Canada for the improvement of stock.

The above declarations are to be attached to the free import entry.

Importation of Seeds into Norway.—A law of 9th May, 1913, makes the following provisions with regard to the marking and colouring of seeds imported into Norway :—

(1) Seed of red clover (*Trifolium pratense*), alsike clover (*Trifolium hybridum*), and timothy (*Phleum pratense*), as well as of all species of spruce (*Picea*) and of all species of pine (*Pinus*)—with the exception of species of "bread pine" (*Pinus cembra* and *Pinus sibirica*)—must, on importation into Norway, be enclosed in sacks. Such sacks must be clearly and conspicuously marked with the words "udenlansk fro" (foreign seeds). The marking may be effected by the Customs authorities at the expense of the consignee. These regulations may be made applicable to other kinds of seed.

(2). The Customs authorities may be empowered to treat the seeds mentioned above with a colouring solution before allowing importation.

(3) The seeds mentioned in (1) must be expressly described as "foreign seeds" on business paper and freight documents. Sales must be made either from the original packing or from other packing which is similarly marked, unless exceptions are made by the Government Department concerned, in respect of certain kinds of coloured seed.

(4) Detailed rules for marking, colouring, &c., shall be issued by the Government Department concerned, which may also issue supplementary regulations with the object of effecting the designation of the above-mentioned kinds of seeds as "foreign seeds" in all commercial transactions.

Export of Live Stock to Uruguay.—The Uruguayan Government have revoked the decree prohibiting the importation of cattle, sheep, goats, and swine from the United Kingdom (*Board of Trade Journal*, June 12th, 1913).

Notes on Agriculture Abroad.

Loans on Agricultural Produce by the Russian State Bank.—According to a supplement to the Russian budget of 1913, the following were the amounts on loan by the Russian State Bank on agricultural produce in the last five years :—

	On 1st January.	On 1st August
	£	£
1908	3,388,000	665,000
1909	3,652,000	581,000
1910	6,091,000	1,246,000
1911	9,120,000	3,198,000
1912	11,622,000	855,000

On January 1st, 1908 and 1909, these amounts were only 5·7 per cent. and 6·9 per cent. respectively of the total discount and loan operations of the Bank, due, it is explained, to the Bank's want of storage room, and to the lack of experience among the *personnel* of the Bank. The extension of the operations in 1909–10 was due to the Russian harvest being good, both as regards quality and quantity, and to the consequent fear of low prices. To prevent this the Bank decided, by an extension of the facilities to agriculturists and merchants for obtaining credit, to give the latter every opportunity of holding back their corn and selling it to the best advantage. With this object rates of discount and interest were lowered, other incidental costs were remitted, and the *personnel* of the Bank was increased. The result was that the amount on loan on the produce rose to £6,091,000 on January 1st, 1910, this amount being 12·4 per cent. of all discount and loan operations.

The quantities of corn given as security in the years 1909, 1910, and 1911 were as follows :—

	1909	1910.	1911
	Tons.	Tons.	Tons
Wheat	813,000	1,532,000	2,116,000
Rye	319,000	576,000	643,000
Oats	227,000	345,000	692,000
Barley	203,000	399,000	679,000
	1,562,000	2,852,000	4,130,000

If the average yield of these four cereals is estimated at about 67,500,000 tons yearly, it will be seen that in 1911 practically 6 per cent. of the total crop was mortgaged with the State Bank. This, as the Russian Minister of Finance remarks, is not a very large proportion, but it must be remembered that the knowledge that it is possible to obtain these loans very easily has a moral effect on the sellers of grain in restraining them from parting with their corn at too low prices, and on the buyers in making them more accommodating in the prices they offer.

The State Bank also places considerable sums at the disposal of agriculturists by lending to zemstvos and local credit organisations. (*Deutscher Reichsanzeiger*, March 6th, 1913.)

Agricultural Exhibition at Dorpat, Russia.—H.M. Consul at Riga reports that the North Livonian Cattle Show and Agricultural Exhibition for 1913 will be held at Dorpat from August 30th to September 2nd (old style). No horned cattle are eligible to compete except such as are owned in the country; only certain classes are open to imported horses, sheep, and pigs, and it is not clear whether they must be the property of residents in the country.

The Exhibition will include an international section for agricultural machinery and implements. In view of the attempt which is being made by the Russian Government to render the country less dependent upon the United States for harvesting and other agricultural machinery, this section should be of importance to British firms.

The Weather in England during June.

District.	Temperature		Rainfall			Bright Sunshine.	
	Daily Mean.	Diff from Average.	Amount	Diff. from Average	Number of Days with Rain	Daily Mean.	Diff. from Average
Week ending June 7th.	°	°	Inches	Inches		Hours	Hours.
England, N.E.	56·0	+2·5	0·43	-0·01	4	8·1	+1·9
England, E. ...	57·3	+1·9	0·18	-0·35	2	6·9	+0·1
Midland Counties	55·7	+0·2	0·34	-0·14	3	7·6	+1·4
England, S.E.	56·0	-0·5	0·22	-0·28	3	7·5	+0·6
England, N.W. ...	55·0	+0·2	0·78	+0·34	4	8·2	+1·3
England, S.W.	54·3	-1·5	0·77	+0·27	4	7·3	+0·3
English Channel	55·6	-1·0	0·39	-0·05	4	8·5	+0·5
Week ending June 14th							
England, N.E. ...	52·6	-1·8	0·16	-0·25	3	6·2	0·0
England, E.	55·3	-0·8	0·27	-0·26	3	7·5	+1·0
Midland Counties ...	54·2	-2·0	0·33	-0·13	3	5·4	-0·7
England, S.E.	55·4	-1·8	0·04	-0·43	1	5·0	-1·7
England, N.W.	52·7	-3·0	0·95	+0·48	4	4·6	-2·1
England, S.W.	53·9	-2·6	0·44	-0·10	4	3·9	-3·0
English Channel	54·6	-2·8	0·12	-0·29	3	3·7	-4·4
Week ending June 21st							
England, N.E.	58·0	+2·0	0·14	-0·28	2	8·3	+2·1
England, E.	60·5	+2·7	0·23	-0·20	1	9·1	+2·3
Midland Counties	59·9	+2·3	0·16	-0·32	2	6·9	+0·8
England, S.E.	60·3	+1·8	0·24	-0·16	1	8·4	+1·4
England, N.W. ...	58·8	+1·8	0·26	-0·32	3	5·6	-0·7
England, S.W. ..	57·9	+0·3	0·10	-0·44	2	5·8	-1·0
English Channel	58·1	-0·4	0·28	-0·13	3	6·8	-1·3
Week ending June 28th							
England, N.E.	57·2	-0·4	0·41	-0·03	4	3·7	-2·9
England, E. ..	57·3	-2·3	0·22	-0·15	3	3·9	-3·5
Midland Counties ..	57·2	-2·0	0·13	-0·35	2	4·9	-1·6
England, S.E.	57·5	-2·7	0·11	-0·26	1	6·0	-1·5
England, N.W.	55·7	-2·5	0·41	-0·18	3	3·6	-2·8
England, S.W. ..	55·9	-2·9	0·23	-0·28	2	7·8	+0·8
English Channel ...	56·7	-3·1	0·11	-0·29	2	9·7	+1·5

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for June, 1913, issued by the International Institute, gives the following forecasts of the production in 1913 in certain countries:—*Wheat.*—Bulgaria, 8,495,000 qr., an increase, as compared with 1912, of 7 per cent.; Denmark, winter wheat, 510,000 qr., an increase of 13 per cent.; Italy, 22,958,000 qr., an increase of 11 per cent.; Luxemburg, winter wheat, 88,000 qr., an increase of 7 per cent.; Russia in Europe (63 Governments), winter wheat, 34,700,000 qr., an increase of 14 per cent.; United States, winter wheat, 61,484,000 qr., an increase of 23 per cent., and spring wheat, 31,492,000 qr., a decrease of 24 per cent.; India, 44,777,000 qr., a decrease of 3 per cent.; and Japan, 3,378,000 qr., an increase of 5 per cent. *Rye.*—Bulgaria, 1,607,000 qr., an increase of 11 per cent.; Denmark, winter rye, 2,097,000 qr., a decrease of 5 per cent.; Luxemburg, winter rye, 83,000 qr., an increase of 9 per cent.; Russia in Europe (63 Governments), winter rye, 106,972,000 qr., a decrease of 9 per cent. *Barley.*—Bulgaria, 2,204,000 qr., the same as in 1912; Denmark, 2,764,000 qr., a decrease of 8 per cent.; Russia in Europe (63 Governments), winter barley, 495,000 qr., a very slight increase; United States, 21,234,000 qr., a decrease of 21 per cent.; Japan, 12,125,000 qr., an increase of 15 per cent. *Oats.*—Bulgaria, 1,413,000 qr., an increase of 14 per cent.; Denmark, 5,331,000 qr., a very slight increase; United States, 113,199,000 qr., a decrease of 22 per cent.

The condition of cereals on June 1st in the countries for which no forecasts of production are given was as follows (100 being taken to represent the prospect of an average crop:—*Wheat.*—Scotland, 100; Norway, 100; Netherlands, 111; Roumania, 120; Sweden, winter 105, spring 103; Switzerland, 97; Canada, 98; Lower Egypt, 109; Upper Egypt. 121. *Rye.*—Scotland, 100; Norway, 80; Netherlands, 99; Roumania, 120; Sweden, winter 94, spring 100; Switzerland, 96; Canada, 98; United States, 101. *Barley.*—Scotland, 100; Luxemburg, 125; Norway, 100; Netherlands, winter 99, spring 108; Roumania, 120; Sweden, 110; Switzerland, 98; Canada, 99; Upper Egypt, 120. *Oats.*—Scotland, 100; Luxemburg. 120; Norway, 100; Netherlands, 120; Roumania, 120; Sweden, 108; Switzerland, 98; Canada, 99. *Maize.*—Bulgaria, 120; Roumania, 120; Switzerland, 100. In Germany, the condition of the crops on 1st June, expressed according to the system of notation of the country (1=excellent, 2=good, 3=average, 4=bad, 5=very bad), was as follows:—Winter wheat, 2·4; spring wheat, 2·5; winter rye, 2·6; spring rye, 2·6; spring barley, 2·4; oats, 2·5. In Austria, the condition expressed on the same system was:—Wheat, 2·4; rye, 2·6; barley, 2·3; oats, 2·3; maize, 2·7.

Belgium.—Final figures of the harvest of 1912 place the production of wheat at 1,918,000 qr., a decrease of 2·5 per cent. as compared with 1911. Rye amounted to 2,486,000 qr., a decrease of 12·5 per cent.; barley to 510,000 qr., a decrease of 4·3 per cent.; and oats to 3,598,000 qr., a decrease of 18·9 per cent. Sugar-beet totalled 1,703,000 tons, which was 14·8 per cent. greater than in 1911.

New Zealand.—The production of wheat in 1912–13, as given in the final figures, totalled 642,000 qr., which is less than in 1911–12 by

35·1 per cent. Oats also showed a large decrease, the production being 1,680,000 qr., or 31·6 per cent. less than in the previous year; but barley was larger by 8·0 per cent., the production being 169,000 qr.

Holland.—An official report giving the condition of the crops on June 10th, states that winter crops have developed most satisfactorily, and only barley will be somewhat disappointing. Spring sowing was occasionally interrupted by rain, but the warm weather in May had a beneficial influence on the later sowings, so that, on the whole, spring cereals are very satisfactory. Excessive rains at the beginning of June, however, were causing injury to several crops. Wheat promises a good crop, barley is almost everywhere satisfactory, and oats are the most promising of the cereals. Rye is frequently short in the straw and light in the ear. Beans, peas, and onions are moderate to good. Potatoes are patchy in several districts, but, on the whole, prospects are not unsatisfactory. Factory potatoes are also promising, but dry weather is needed. Heavy crops of hay are expected. (H.M. Consul at Rotterdam, June 17th.)

Hungary.—The official report of June 23rd estimates the yield of wheat at 18,476,000 qr., compared with 21,660,000 qr. in 1912, and that of rye at 5,950,000 qr., compared with 6,315,000 qr. Barley is satisfactory, oats are poor, and maize promises an average yield.

Russia.—According to information obtained by the Central Statistical Committee, the condition of the sowings to June 14th was as follows:— Of the 81 Governments in which sufficient information was gathered, winter sowings were unsatisfactory in only 4 Governments, and spring sowings in 6 Governments. In the remaining Governments the condition of both winter and spring crops was either satisfactory or more than satisfactory. The appearance of the crops was rather less favourable than at the same time last year. (*Broomhall,* July 5th.)

Sugar Beet.—H.M. Commercial Attaché at St. Petersburg reports that it is officially estimated that by June 14th the total area of Russian beet sowings amounted to 1,808,395 acres, compared with 1,889,902 acres by the same date last year. The general condition of the crop is fully satisfactory.

Italy.—The official report for the first ten days of June stated that in the south and in Sicily the cereal harvest had begun with good results in general, and the same results might be expected in the rest of Italy, although in some districts the excessive heat and drought had hindered the regular ripening of the crops. Hemp, maize, pulse and vegetables continued promising, but for these crops also rain was wanted in some districts. Hay had been cut and the yield was satisfactory. (*Broomhall,* June 28th.)

India.—The Final General Memorandum on the wheat crop of 1912–13 gives the acreage as 29,542,000 acres, a decrease of 1,599,000 acres, or 5·1 per cent. on the previous year; but an increase of 7·8 per cent. on the average of the five years ending 1910–11. The total production was 9,597,700 tons, a decrease of 326,800 tons, or 3·3 per cent. on the previous year; but an increase of 1,229,300 tons, or 14·7 per cent. on the average of the 5 years ending 1910–11.

Canada.—A bulletin issued on June 30th by the Census and Statistics Office at Ottawa states that the cold and dry weather of May, accompanied by frequent night frosts, while favourable to seeding, retarded the crops already sown, so that they are unusually backward. The total area under wheat in Canada is provisionally estimated at 9,816,300 acres, or 57,900 acres more than in 1912. Oats occupy 9,608,500 acres, an increase of 391,600 acres; barley, 1,425,200 acres, an increase of 10,000 acres. On May 31st the condition of the crops was reported as generally favourable throughout the country. Taking 100 as representing the promise of a full crop, the condition of winter wheat was 80·62, spring wheat 91·55, oats 91·72, and barley 91·19. At the corresponding date last year the condition of winter wheat was only 71·46. All the other crops were then above 90.

United States.—The Department of Agriculture gives the following estimates of the yield of the cereals as indicated by their condition on July 1st (in bushels):—Winter wheat, 483,000,000, compared with 399,919,000, the final figures of 1912; spring wheat, 218,000,000, compared with 330,348,000; maize, 2,971,000,000, compared with 3,124,746,000; oats, 1,031,000,000, compared with 1,418,337,000; rye, 39,332,000, compared with 35,664,000; and barley, 165,000,000, compared with 223,824,000. (*Dornbusch,* July 9th.)

Live Stock in Belgium.—The number of horses on December 31st, 1912, was 262,709, as compared with 261,967 in 1911, the increase amounting to 0·3 per cent. Cattle totalled 1,830,747, against 1,812,191, an increase of 1·0 per cent; and pigs 1,348,514, against 1,229,428, an increase of 9·7 per cent. (*Bulletin of Agricultural Statistics,* June, 1913.)

Fruit and Vegetable Crops Abroad.

The following extracts from reports furnished by certain of H.M. Consuls show the conditions and prospects of the fruit crops in France, Holland, and Belgium, including vegetables in France.

France.—Generally speaking, this year's fruit crop is an exceedingly bad one, but vegetables have been produced in sufficiently large quantities up to the present. Considerable quantities of potatoes have arrived at Paris from Brittany, St. Malo, and Cherbourg and its neighbourhood; considerable consignments are also being received from Spain. Potatoes are being sold at 6*s.* to 10*s.* per cwt., according to the quality and the district where produced.

There is only half the usual crop of peaches in the Perpignan district; the crops are poor in the Var and Rhone Valley, and in other parts there is hardly any fruit. The probable price will range from £2 to £4 per cwt., according to quality. There is a very scanty crop of prunes (Reine Claude), and prices will be about £2 10*s.* to £4 per cwt. The common prune is scarce, and it is difficult to give any estimate

as to selling prices. Mirabelles are a poor crop; prices will probably be £1 4s. to £1 12s. per cwt. Pears will be below average. A good crop of apples and a plentiful supply of nuts are expected.

Reports from different districts are set out below:—

Côtes-du-Nord.—The very rough, cold, windy weather in early spring was most prejudicial to fruit trees, such as plum, peach, and apricot, so that the crop is a failure. There is promise of a plentiful crop of gooseberries, and a very good crop of strawberries. With favourable weather a full crop of apples may be expected.

Morbihan.—The crop of pears will be slightly under average and less abundant than last year. An abundant crop of apples for cider-making is expected. There will be a poor crop of cherries, very small crops of peaches and strawberries, and the crop of plums will be practically of no value. With the exception of apples, the crops will be so small that it will be impossible for growers to export their products.

Loire-Inférieure.—Good crops of pears are expected.

Maine-et-Loire, Mayenne, and Sarthe.—Black currants are more abundant than in 1912, but the crop is variable. A small crop of some varieties of cherries may be obtained, but on the whole the crop is a failure. Very small crops of plums will be obtained, whilst pears will be below average, especially dessert pears. There will be a very small crop of nuts. Very abundant crops of strawberries and good crops of apples are looked for. Prices are expected to be very high.

Ille-et-Vilaine.—A good crop of apples is looked for, and a fair crop of pears. There will be a full crop of black currants, which are expected to sell for £25 per ton. Red currants promise a good crop, and are expected to make £18 to £22 per ton; whilst gooseberries, also a good crop, will probably sell for £18 per ton. There is a fair crop of cherries, but plums are a bad crop.

Calvados.—Appearances are not very favourable for fruit in this Department. Stone fruit suffered much from the frosts during the flowering period. Eating apples and pears promise a medium to small yield, according to localities. In the Honfleur district there are good prospects for "Williams," but only a quarter of a crop is expected of "Duchesse," and two-thirds of a crop of winter varieties. Pears for perry are a failure, but cider apples promise well. Plums are a failure, and cherries are unsatisfactory in general. Currants and gooseberries seem likely to yield only half a crop.

In the Bordeaux district, after a period of about ten days' brilliant sunshine and hot weather, which caused an immense amount of good to the vines, a sudden change occurred which, should it continue, will seriously jeopardise the wine crop. Mildew has already made its appearance in the southern departments, most of the vineyards being attacked here and there.

Germany.—In East and West Prussia and Posen, red currants and raspberries are generally described as scarcely medium. In sheltered places they are fairly good to medium, but where exposed 80 to 90 per cent. of the bushes have suffered. Gooseberries are good in sheltered places, but 70 per cent. of the crop suffered from frost. There are hardly any apricots and peaches. Sweet cherries are very scarce, while the sour varieties, although fairly good in some places, are frequently

a failure. Plums and damsons are mostly good, and a fair crop of apples and pears is expected.

Holland.—The prospects for the apple crops in Groningen, near Leeuwarden and Drachten, are reported to be fairly good. Fair crops of pears are expected in Groningen, Friesland, Overyssel, and Guelderland, north of the Rhine. In the Tielerwaard and round Utrecht the early cherries are good, whilst late cherries are fair in the Tielerwaard, Bommelerwaard, and Betuwe, and fairly good round Utrecht. Prospects for damsons are fair in the south-western part of the province of Utrecht; in other parts of the country they are very bad. The condition of plums is good in Upper Betuwe and Groningen; fair in Overyssel, Guelderland north of the Rhine, around Utrecht, and Lower Betuwe; rather bad in the Tielerwaard, and bad in the Bommelerwaard. Peaches grown under glass in Overyssel and in Guelderland north of the Rhine are reported to be fair; but prospects for those grown in the open are rather bad in those districts and fair in Betuwe and Utrecht. In the Tielerwaard, the Bommelerwaard, and near Utrecht fair crops of red and white currants are expected. Gooseberries are fairly good in the Beemster, Lower Betuwe, and the Vecht district, and fair in Upper Betuwe, Tielerwaard, and Utrecht. Raspberries are reported to be fairly good near Utrecht, in the Tielerwaard, and near Leeuwarden, and fair in the Lower Betuwe and near Groningen. There are good prospects for walnuts in the Lower Betuwe, and fair prospects in the Tielerwaard and near Utrecht.

Belgium.—In the Province of Antwerp plums, of which the chief varieties grown are greengages, Louvain, mirobolans and Victorias, are very scarce. Gooseberries promise a poor crop in comparison with last summer. Pears are altogether unsuccessful, and apples were considerably damaged by hail. In the Ghent district bad crops of all varieties of plums are expected, fair crops of gooseberries, cherries, currants, and late varieties of apples, and bad crops of early varieties of apples and pears. In the Bruges and Ostend districts strawberries promise an abundant crop of good quality; black currants will also give an abundant crop; but red and white currants and gooseberries promise only half a crop. A very poor crop of plums is expected. In the Bruges district cherries promise an excellent crop of very good quality, but in the Ostend district only an average crop is expected. Apples and pears seem to be a small crop in the Ostend district, but very good in the Bruges district.

The following varieties are exported to the United Kingdom:—Black currants, cherries, strawberries, plums, pears, and apples; and it is estimated that black currants will sell at about 1½*d.* per lb., and strawberries at 2½*d.* per lb.

In the Liége district the consensus of opinion among the leading fruiterers is that the yield will, in general, be satisfactory. Cherries, except some early varieties are abundant in all parts. There is also a good yield of plums, greengages, and nectarines. Peaches and apricots suffered a good deal from snow in April. Pears also suffered, but not to the same extent. A large yield of apples is expected everywhere.

Agricultural Conditions in England and Wales on July 1st.

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on the 1st July, state that June was a warm and dry month, which, on the whole, was not detrimental to the wheat crop; indeed, in the more humid western districts, the month appears to have been favourable, but on the eastern side it was rather too dry. Wheat generally, on lighter soils, looks healthy and well, but is poorer on land that received too much wet in the winter. The yield for the country generally is expected to prove rather below average; it is more nearly average in the north. Although below normal, it is nevertheless, upon the whole, decidedly the best of the three corn crops. Neither barley nor oats is satisfactory, especially the latter, but both seem to be rather better in the north than in the south. Straw is generally reported to be short. Beans are a better crop, though they also will probably be just below the mean; in some places the bean-aphis has been troublesome. Peas are not so good as beans, and were needing rain badly.

Early potatoes have already been dug in some districts, with variable results. Later varieties, including the main-crop, however, do not look well; and the crop throughout the country is expected to prove below average (except in most parts of Wales).

Roots are naturally very backward; considerable areas of turnips and swedes had yet to be sown in every part of England and Wales; fly has often been troublesome, and the drought has generally prevented the plants getting a start. Where the plant is showing, however, especially that sown early and in good soil, it is mostly a fair plant and healthy. Mangolds are very generally a thin and patchy plant, and prospects are decidedly poor. Rain was everywhere urgently wanted for the roots, and would much improve their prospects.

Hay-making is, upon the whole, rather early, and in most parts of the south at least a large proportion had been cut and carted by the end of the month. Crops are generally heavy, especially seeds' hay, while meadow hay, although lighter than seeds, is nearly everywhere above the average. The crop has, perhaps, proved not quite so bulky as was anticipated a month ago, but it is a distinctly good one upon the whole. The weather has proved excellent for the in-gathering, and the crop has so far been got in in very good condition.

Pastures have, upon the whole, stood the dry weather very well, and they are mostly full of grass, though now beginning to get bare in some districts. Live stocks have generally thriven during the month.

Hops have generally suffered much from aphis. On good soils, the weather has not been unfavourable during the month, but hops on poorer or heavy lands are not satisfactory. The yield, on present appearances, is likely to be poor; in Kent prospects are variable, but throughout the county as a whole the crop is expected to be somewhat under average, and considerably less than last year; the reports from the western counties are much worse, and indicate a yield in that division of about 20 per cent. below the mean. Good rains would effect considerable improvement, as at present the hops are often not making much growth.

Prospects for fruit have deteriorated considerably since the last report, especially tree-fruit, much of which has fallen owing to the drought, while aphis, particularly on the plum, has done damage. Strawberries have generally been a good crop, although south of the Thames, where large quantities are grown, they have hardly been above average. Raspberries and gooseberries are about average, but currants are rather below. Among orchard-fruit apples are the least unsatisfactory; there are, rather as an exception, some good crops, but the yield as a whole is expected to be poor; while cherries, pears, and plums are very deficient, and in some places a failure.

Labour is reported to be none too plentiful as a rule, particularly in the more northern parts of the country, and a strike among agricultural labourers in Lancashire has increased the difficulty.

Summarising the returns, and expressing an average crop by 100, the condition of the crops on the 1st July indicated probable yields which may be denoted by the following percentages:—Wheat, 98; barley, 93; oats, 91; beans, 99; peas, 96; potatoes, 96; mangold, 92; seeds' hay, 108; meadow hay, 103; hops, 92.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on July 1st, 1913, certain diseases of animals existed in the countries specified:—

Austria (for the period June 18th—25th).
Anthrax, Blackleg, Foot-and-Mouth Disease (total of 137 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period May 16th—31st).
Anthrax, Blackleg, Foot-and-Mouth Disease (39 outbreaks in 15 communes), Glanders and Farcy, Rabies.

Bulgaria (for the period May 29th—June 6th).
Blackleg, Foot-and-Mouth Disease, Sheep Pox.

Denmark (month of May).
Anthrax, Foot-and-Mouth Disease (1 outbreak), Glanders and Farcy, Swine Erysipelas.

France (for the period June 8th—14th).
Anthrax, Blackleg, Foot-and-Mouth Disease (1,130 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period June 1st—15th).
Foot-and-Mouth Disease (28 infected places in 5 parishes), Glanders and Farcy, Swine Fever.

Holland (month of May).
Anthrax, Foot-and-Mouth Disease (3 outbreaks in 2 provinces), Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (for the period June 4th—11th).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 101 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period June 9th—15th).
Anthrax, Blackleg, Foot-and-Mouth Disease (2,701 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period March 1st—15th).
Nil.

Norway (month of May).
Anthrax, Blackleg.

Rumania (for the period May 29th—June 5th).
Anthrax, Dourine, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of February).
Anthrax, Foot-and-Mouth Disease (1,223 animals in 57 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (no further returns received).

Spain (month of April).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (1,299 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of May).
Anthrax, Blackleg.

Switzerland (for the period June 16th—22nd).
Anthrax, Blackleg, Foot-and-Mouth Disease (99 "étables" and Alpine-Pâturages entailing 2,149 animals, of which 23 "étables" and Alpine-Pâturages were declared infected during the period), Swine Fever.

Agricultural Labour in England during June.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in June:—

There was practically no interruption from wet weather to outdoor employment in June, and extra labourers (men outside the regular farm staff) were generally well employed on hoeing roots and hay-making. In some districts, however, it was reported that there was less demand for these men than usual, as less hoeing was necessary on account of the dry weather.

Reports of an insufficient supply of extra men were received from many districts.

THE CORN MARKETS IN JUNE.

C. KAINS-JACKSON.

British Wheat.—The markets have had but a short supply as a rule, and prices have varied from 28*s.* 4*d.* in places of exceptional depression up to 35*s.* 4*d.* in centres of good quality production. Of the latter, East Kent keeps to the full its old predominance, while exchanges of the Home Counties and Thames Valley continue to rank as decidedly high quality markets. Seeing what fine wheat samples are found in East Anglia and how large a proportion of fine lots at Mark Lane are of East Anglian origin, many wonder that the averages from all that region, including Lincoln and the Fens, are not higher. The explanation may possibly be found in the large total quantities sold at the exchanges of the great producing districts. Where wheat production is restricted, tailings may easily be absorbed on the home farm; where it is more of an important industry, the home requirements being satisfied, there still remains a good quantity to send to market. On the month, changes in the average are quite trivial both in London and the country, while, as compared with a year ago, the decline in price rather exceeds four shillings per quarter. The condition of June deliveries was very good; but quality had been affected by the season of last year, and was uneven.

Colonial and Indian Wheat.—The new crop in India is officially put at a total which, while not equalling that of last year, is above the decennial average, and promises very reasonable exports. The Canadian wheat is for the most part a spring-sown crop, and reports of its progress are not yet definite enough to affect the markets. Indian wheat has declined a penny to twopence per cental on the month, and the supply on passage has increased. The present prices is 7*s.* 8*d.* to 7*s.* 9*d.* for white and 7*s.* 7*d.* to 7*s.* 8*d.* for red. Canadian has declined 1*s.* per quarter at Mark Lane for all sorts except the first two grades. The latter are extremely scarce. Australian wheat is a good steady supply, and 40*s.* per qr. is still about the lowest quotation. New Zealand has no export surplus this season, while South Africa and Egypt are importing and not exporting wheat.

Foreign Wheat.—Most sorts are 1*s.* cheaper on the month, the excellent yields of winter type in the United States and Italy being against holders, while the growing crops in Russia and Central Europe are well spoken of. In France the outlook has been called "below an average," but as spot prices at Paris are nearly 2*s.* per qr. higher than for September delivery, the exchanges are supposed to be withholding their endorsement from the crop reports. The price of Pacific States wheat is decidedly lower, and the market is not good. America offers to ship average quality new crop winter wheat at 7*s.* 4*d.* per cental, and this price, which means 35*s.* 3*d.* per qr. at Tilbury or 36*s.* ex-warehouse, may be taken as that which the best market opinion of the hour expects to be the opening value of a new cereal year.

Supplies and Shipments.—The imports of breadstuffs, including flour, during June exceeded three million quarters. As this exceeds total requirements, without reckoning home production at

all, its effect on the exchanges has naturally been of a depressing nature. In round numbers, weekly imports in June, 1912, averaged 595,000 qr. of breadstuffs, but in June, 1913, 730,000 qr. The shipments from North America were 2,420,000 qr. of wheat, and exerted a special influence by reason of the comparatively rapid sea transit. The trade is mostly a steamer one. South American exports dropped to 812,000 qr., but any relief that might have been felt was dissipated by the weekly telegrams of even date announcing large shipments of the new Indian crop. These when the month was finished proved to be 1,218,000 qr. Russia in June shipped 1,155,000 qr.; South-eastern Europe, 227,000 qr.; and Australia, 479,000 qr. The supply on passage on the 30th ult. was 3,400,000 qr., which, although a large total, showed some decline on the month.

Flour.—The flour markets have throughout been exceedingly dull, and prices, if maintained for actual milling flour, are lower for the by-products of the mill. These have scarcely ever been cheaper than at the present moment. There are now 260,000 sacks of flour on passage—a full prospective supply. North America in June shipped 427,000 sacks; Australia, 30,000 sacks; and Adriatic ports, 18,000 sacks. The last consist almost wholly of Hungarian flour exported *viâ* Trieste and Fiume.

Barley.—English is hardly in evidence. London sales were only 123 qr. in four weeks, yet this was much above the standard of the majority of country markets. The price has been on a feeding level only, the malting samples being scarcely quoted. Imported barley has fallen 6*d.* per qr. for foreign sorts, and also for Indian. The latter has a fair sale, and so has Russian, which, however, is scarce on spot. American is very inferior, and is hard to place. Supply has been moderate, but demand still more so. There are 400,000 qr. on passage. Shipments for June were 195,000 qr. from North America; 1,075,500 qr. from Russia; 112,000 qr. from Europe S.E.; and 232,000 qr. from India.

Oats.—The deliveries of English oats at the end of June were much below the average, although at midsummer these are always very small. The yield of 1912 was below average, and it is therefore especially to be regretted that the outlook for the approaching harvest by no means points to an average crop. The holders of old oats may safely depend, it would seem, on a good market for them and at good prices. Imported oats are usually deficient in quality, and a fall of 1*s.* per qr. in the price asked does not meet the situation, which is one that demands an average quantity of fair average grade. At least 80 per cent. of the imports for June were of 304 lb. and less natural weight per qr. June shipments were 307,000 qr. from North America, 379,000 qr. from South America, and 169,000 qr. from Russia. There were 410,000 qr. on passage on June 30th.

Maize.—Argentine exports of new crop have not constituted a record, June, 1913, shipments being less than those of November, 1912, and August, 1912. But for the last six trading days of June they exceeded a million quarters, and this had not been attained before. Weaker markets have resulted from this haste of Argentina to ship, the more so as the Continent has not been buying very freely, and the result

was that on the 30th ult. over 1,400,000 qr. were on passage to the United Kingdom. Other countries' June shipments were from the United States, 60,000 qr.; Russia, 202,000 qr.; and S.E. Europe, 259,000 qr. Shipments from Burma have been trivial, and from South Africa *nil*. The one encouraging feature for holders into July was that prices for autumn delivery were a penny and twopence per cental higher than for supply in the last two months of the waning cereal year. The spot value as June closed was 4*s*. 10*d*. per cental; that for new season delivery beginning September 1st, 5*s*. These prices were for average quality yellow corn from Argentina. The new crop in South America is of excellent mean quality, and is being shipped in good condition.

Oilseeds.—Large wholesale buyers of linseed for cash have been able to obtain fair average quality at two guineas per qr., a decline of a full guinea from the prices of recent years. Cotton-seed shows little change; nearly 9*s*. per cwt. is paid even by large cash buyers. There are now 350,000 qr. of linseed on passage, and 31,000 tons of cotton-seed. The shipments of linseed for June were 105,000 qr. from the United States, 232,000 qr. from India, and 392,000 qr. from South America,

Various.—Beet sugar has remained cheap, mostly 9*s*. 6*d*. to 9*s*. 7*d*. per cwt. Beans have been steady. Some excellent old crop English have been delivered in London at 36*s*. per 532 lb., good weight. English maple peas at 37*s*., Calcutta white at 34*s*., and Karachi gram at 30*s*., all per 504 lb., have had a fair sale for the time of year.

THE LIVE AND DEAD MEAT TRADE IN JUNE.

A. T. MATTHEWS.

Fat Cattle.—Supplies were again below the average, but the cattle have continued to come out in good condition. The weather was very changeable as regards temperature, but the hot spells have been of short duration. Great heat with a sultry atmosphere has at times affected the trade, and caused butchers to prefer animals carrying only a moderate amount of fat, and this tendency is shown in the comparative averages of May and June. Shorthorns averaged, in about twenty-three English markets, 9*s*. 3*d*. and 8*s*. 6*d*. per stone for first and second quality, against 9*s*. 5*d*. and 8*s*. 7*d*. in May; Herefords, 9*s*. 6*d*. and 8*s*. 9*d*., against 9*s*. 8*d*. and 8*s*. 10*d*.; Devons, 9*s*. 5*d*. and 8*s*. 4*d*., against 9*s*. 5*d*. and 8*s*. 6*d*.; and Polled Scots, 9*s*. 6*d*. and 8*s*. 10*d*., against 9*s*. 6*d*. and 9*s*. per 14-lb. stone.

Until nearly the end of the month the disparity between certain English markets, so observable in May, continued, the highest prices being realised in the south and west, but in the week ending June 25th values were singularly even, there being only 5*d*. per stone difference between the highest and lowest. This was probably owing to the appearance of grass-fed cattle, which has equalised the conditions of supply. Up to the present grass has been fairly plentiful, and, the weather being dry, cattle have thriven well, as they usually do under these conditions. Drought, however, has arrested growth in the pas-

tures, and, if continued, stock will be hurried to market, with lower prices as the result.

Veal Calves.—The supplies of calves have been moderate, and prices have been about maintained. In the first two weeks the averages in English markets stood at 9½*d.* and 8½*d.* per lb., but afterwards these receded about ¼*d.*

Fat Sheep.—Although considerably fewer sheep are being marketed than at this time last year, prices are no higher per lb., but farmers are getting more money for them owing to superior condition, for there is a very striking contrast between the two seasons in this respect. Values have slightly receded during June, but the fall has not exceeded ½*d.* per lb. In over twenty English markets Downs averaged 8¾*d.*, 8*d.*, and 6¾*d.* for the three qualities, against 9*d.*, 8*d.*, and 7*d.* in May; Longwools, 8¼*d.*, 7½*d.*, and 6*d.*, against 8½*d.*, 7½*d.*, and 6¼*d.*; prime Cheviots, 9½*d.*, against 9¾*d.*; and prime Cross-breds, 8¾*d.*, against 9*d.* per lb. It is perhaps rather singular that second quality Downs and Longwools (which means larger and heavier sheep) should have retained previous values better than the light weights, which generally are in better demand during warm weather. Probably this may be owing to the competition of fat lambs with small mutton.

Fat Lambs.—There have been ample supplies of lambs, and the demand has been fairly good. Average prices have declined during the month, and were some ¾*d.* per lb. lower than those of May, but this is only a normal movement as the lambs increase in size. The average, in about thirty-five English markets, was 10½*d.* and 9½*d.* per lb. for first and second quality, against 11¼*d.* and 10¼*d.* in May. There was a rather wide range of prices at different markets.

Fat Pigs.—Bacon pigs have scarcely maintained May values, but average prices are only 2*d.* per 14-lb. stone lower. In twenty-four English markets they were 8*s.* 3*d.* and 7*s.* 9*d.* for small and heavier pigs.

Carcass Beef—British.—London markets have been rather scantily supplied with Scotch beef, and prices (especially for short sides) have been higher. These averaged 4*s.* 11*d.* and 4*s.* 9*d.* per 8-lb. stone, against 4*s.* 8*d.* and 4*s.* 6*d.* in May. There was less change in Scotch long sides, and none at all in English. The former averaged 4*s.* 7*d.* and 4*s.* 5*d.*, against 4*s.* 6*d.* and 4*s.* 5*d.*; and English, 4*s.* 6*d.* and 4*s.* 5*d.* per stone. On the third Wednesday in the month there was much depression owing to the heat.

Canadian Beef.—Some Canadian sides from Deptford have been in evidence each week, and sold at an average of 4*s.* 4*d.* and 4*s.* 2*d.* for first and second quality. Those sides which have come under the writer's observation were not at all well finished.

Chilled Beef.—There have been smaller supplies of Argentine chilled, and a much steadier trade. In the second week there was a great demand for fore quarters, and, in the fourth, hind quarters were scarce and very dear in proportion. The averages for the month were 3*s.* 3*d.* and 3*s.* for hinds, and 2*s.* 2*d.* and 2*s.* for fores, showing an advance on May prices of 3*d.* per stone for best hind quarters, but only about 1*d.* for fores.

Frozen Beef.—This trade has been very quiet, but there was a little more doing than in May, when prices were almost nominal. June

averages were 2*s*. 7*d*. and 2*s*. 5*d*. per stone for hind quarters, and 2*s*. 2*d*. and 2*s*. for fores. Argentine "hard" beef has made nearly as much as New Zealand.

Carcass Mutton—Fresh Killed.—British mutton somewhat improved in value, but the demand has never been very keen. In the second week small Scotch nearly touched 9*d*. per lb., but the weather in the next week affected the price by nearly 1*d*. per lb. Scotch averaged 5*s*. 6*d*. and 5*s*. 3*d*., and English 5*s*. 2*d*. and 4*s*. 9*d*. per stone, an advance of ¼*d*. per lb. for the month. There has been some Dutch mutton on the market each week, which has averaged 4*s*. 6*d*. per stone.

Frozen Mutton.—New Zealand mutton has been very steady at May prices till the last week, when there was an advance of ¼*d*. per lb. Previously the value was 2*s*. 6*d*. to 3*s*. per stone. Argentine can be quoted at 2*d*. and Australian at 4*d*. per stone less money.

Lamb—Fresh Killed.—British lamb again declined in value by over ½*d*. per lb., as compared with that of May, but with the exception of the hot week the best made 6*s*. 4*d*. per stone. The averages were 6*s*. 3*d*. and 5*s*. 9*d*. for first and second quality. Dutch lamb was offered in limited quantity, and realised 5*s*. 8*d*. per stone.

Frozen Lamb.—This trade was almost entirely confined to New Zealand produce, which has been in very good demand at 4*s*. to 4*s*. 6*d*. per stone till the last week, when there was a decline of ¼*d*. per lb.

Veal.—Prime veal has met a steady sale at somewhat reduced rates. Beginning at 5*s*. to 5*s*. 8*d*., the price of British since the first week was 4*s*. 8*d*. to 5*s*. 4*d*., with lower qualities at much less money. Dutch has usually exceeded English by 4*d*. per stone.

Pork.—With a trade of small dimensions, prices have been high for the time of year. British averaged 5*s*. for prime small, and 4*s*. 6*d*. for second quality, the top price in the hot weather being 4*s*. 8*d*.

THE PROVISION TRADE IN JUNE.

HEDLEY STEVENS.

Bacon.—Prices for long sides have fluctuated during the month, more especially for fat types, as, on account of the warm weather, there has been a difficulty in disposing of that description. Towards the end of the month the killings in Denmark were less; and with less fat bacon arriving from Holland, Continental meats were from 3*s*. to 4*s*. per cwt. dearer, and other descriptions of bacon were in consequence firmer. American markets continue to advance, and almost prohibitive prices are demanded for hams for June and July shipments. The consumptive demand in America continues good for all hog products, and shipments to this country consequently continue small. Prices of hogs at Chicago for the month have ranged from \$8.30 to \$8.90, against \$6.90 to \$7.70 last year, and \$5.75 to \$6.60 two years ago. The scarcity of hogs in Canada continues, and shipments of cured meats to England are very small, necessitating the freer use of Dutch and Russian by dealers who usually handle Canadian.

In sympathy with the advance in Continental long sides, both English and Irish sides now command more money. English pigs continue

scarce, and command high prices. The English curers draw attention to the reduced arrivals of pigs from Ireland for the first 25 weeks of this year, the number being about half the quantity for the same period last year—186,784 in 1912, and 97,391 in 1913.

Cheese.—Contrary to general expectations, prices of most descriptions of cheese have steadily advanced throughout the month. This has been especially so with Canadian and New Zealand makes. Up to now the make of cheèse in Canada is reported to be below that of last year on account of the late spring, and the receipts at Montreal tend to confirm these reports. It is thought by many, however, that a large make is in progress, the weather conditions being favourable; while the arrivals at the shipping point are smaller owing to factorymen holding their cheese in curing-rooms longer than usual in response to the advice given by the Canadian Department of Agriculture, serious complaints having been made as to the "green" condition of the summer makes shipped to England last year, with consequent loss in weight and depreciation in quality. Receipts at Montreal this year are 252,000 cheese, against 295,000 for the same period in 1912. The shipments have been 166,000 cheese this season, against 210,000 in 1912, and 198,000 in 1911. On spot the demand for New Zealands has been good, and prices generally advanced, thus reducing the loss to those who contracted at high prices. Estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 93,000, against 83,000 at the same time last year, and 118,000 two years ago. Estimated stocks of New Zealand cheese in London and Bristol at the end of the month were 15,500 crates (two cheese in each), against 4,000 last year.

On account of the advance in prices of Canadian and New Zealand cheese, there has been an exceptionally good demand for the new make of English cheese for immediate consumption. The make in most districts is well up to the average, although reported to be less in June, the warmer weather having increased the demand for milk in the cities.

Butter.—The demand for foreign and colonial makes of butter has been only moderate, as with the favourable weather conditions there has been a lot of home make on offer, also plentiful supplies from Ireland. Prices are about the same as those current at the same time last year. Large shipments of satisfactory quality are arriving from Siberia. In Canada and the United States prices are above an export basis.

In a recent issue of the *Montreal Bulletin*, the editor writes:—

"The North-west and Coast trade so far this season has been a disappointment, the total business being not over one-third of the business worked during the same period last year. The previous reported sales of creamery butter for American account were purely speculative, the goods being stored here in expectation of the duty on butter being reduced 3c. per lb.

"The stocks of butter must be accumulating very fast, as production is fast catching up to that of a year ago."

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in June and May, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	June. First Quality.	June. Second Quality.	May. First Quality.	May. Second Quality.
FAT STOCK:—	per stone*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots ..	9 6	8 10	9 6	9 0
Herefords	9 6	8 9	9 8	8 10
Shorthorns	9 3	8 6	9 5	8 7
Devons	9 5	8 4	9 5	8 6
Welsh Runts	9 4	—	9 4	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d
Veal Calves .. .	9½	8¼	9½	8½
Sheep:—				
Downs	8¼	8	9	8¼
Longwools	8¼	7½	8½	7¾
Cheviots	9½	8½	10	9¼
Blackfaced	8¾	8	9¾	8¾
Welsh	9¼	8½	10¼	9¼
Cross-breds	8¾	7¼	9	8¼
	per stone*	per stone.*	per stone*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	8 3	7 9	8 5	7 11
Porkers	8 8	8 2	8 10	8 3
LEAN STOCK:—	per head	per head.	per head	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ..	23 0	19 0	23 9	19 4
,, —Calvers	22 1	18 5	22 6	18 16
Other Breeds—In Milk ...	21 2	17 15	20 17	17 11
,, —Calvers ...	17 5	15 0	17 5	14 12
Calves for Rearing .	2 14	2 2	2 12	2 0
Store Cattle:—				
Shorthorns—Yearlings ..	11 15	10 3	11 16	10 4
,, —Two-year-olds	15 19	13 16	16 7	14 6
,, —Three-year-olds	20 12	17 15	20 6	17 12
Herefords —Two-year-olds	18 5	16 0	18 14	15 16
Devons— ,,	15 18	14 10	16 7	14 16
Welsh Runts— ,,	16 14	14 7	16 15	14 15
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	41 7	39 1	51 9	45 2
Store Pigs:—				
8 to 10 weeks old	26 9	21 1	26 7	21 3
12 to 15 weeks old	37 6	29 10	37 7	29 11

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in June, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.		Leeds.		Liverpool.		London.		Manchester.	
		per cwt.		per cwt.		per cwt.		per cwt		per cwt.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF:—											
English	1st	63	0	62	6	62	0	62	6	63	6
	2nd	57	6	60	6	57	6	61	6	60	0
Cow and Bull	1st	53	6	56	0	54	0	49	6	55	0
	2nd	49	6	51	6	45	0	45	0	50	0
Irish: Port killed	1st	—		61	0	62	0	—		—	
	2nd	—		—		56	6	—		—	
Argentine Frozen—											
Hind Quarters	1st	38	0	37	6	37	6	36	0	37	6
Fore ,, . . .	1st	30	6	31	0	30	6	29	0	30	6
Argentine Chilled—											
Hind Quarters	1st	41	6	44	6	42	6	46	0	42	6
Fore ,, ...	1st	31	6	31	0	30	6	31	0	31	0
Australian Frozen—											
Hind Quarters	1st	35	6	36	6	33	0	36	0	33	0
Fore ,, ...	1st	31	0	30	6	30	6	29	0	30	6
VEAL:—											
British	1st	—		77	0	85	0	76	0	78	6
	2nd	74	6	72	6	73	6	66	6	74	6
Foreign	1st	—		—		—		78	0	—	
MUTTON:—											
Scotch	1st	—		—		81	0	77	6	81	6
	2nd	—		—		74	6	74	0	77	0
English	1st	70	6	74	6	74	6	71	6	77	6
	2nd	61	0	71	6	69	0	66	6	73	0
Irish: Port killed . .	1st	—		—		74	6	—		—	
	2nd	—		—		69	0	—		—	
Argentine Frozen	1st	41	0	40	6	40	0	39	6	40	0
Australian ,, ...	1st	37	6	39	0	36	6	37	6	36	6
New Zealand ,, ...	1st	42	0	—		—		42	6	—	
LAMB:—											
British ...	1st	83	0	90	6	84	6	87	6	85	6
	2nd	80	6	85	0	76	0	80	6	81	0
New Zealand	1st	62	0	63	0	62	0	62	6	62	0
Australian	1st	58	0	57	6	55	6	—		55	6
Argentine	1st	57	0	—		56	0	—		56	0
PORK:—											
British	1st	72	6	68	0	71	0	70	0	75	0
	2nd	65	6	66	0	65	6	64	0	70	0
Foreign	1st	—		—		—		67	6	—	

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913.

Weeks ended (*in* 1913).	Wheat.			Barley.			Oats.		
	1911.	1912.	1913.	1911.	1912.	1913.	1911.	1912.	1913.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 4	30 5	33 2	30 5	23 11	33 3	28 6	17 0	20 7	19 10
,, 11	30 8	33 1	30 3	23 10	33 0	28 4	17 2	20 8	19 2
,, 18	30 11	33 4	30 5	24 4	33 3	28 6	17 4	20 11	19 4
,, 25	30 11	33 7	30 11	24 5	33 1	28 10	17 3	21 1	19 4
Feb. 1	30 9	33 8	31 1	24 5	32 10	28 11	17 5	21 3	20 2
,, 8	30 5	34 0	31 0	24 6	33 2	28 10	17 5	21 4	20 1
,, 15	30 3	34 4	30 9	24 7	32 10	29 1	17 6	21 7	20 2
,, 22	30 2	34 6	30 11	24 9	32 8	28 8	17 7	21 9	20 7
Mar. 1	30 0	34 1	31 0	25 0	32 0	28 6	17 5	21 6	20 4
,, 8	30 1	34 1	31 3	25 0	31 7	28 5	17 5	21 8	20 0
,, 15	30 1	34 0	31 1	24 11	31 2	27 11	17 6	21 8	20 2
,, 22	30 2	34 1	31 1	25 0	31 10	28 6	17 5	21 9	19 11
,, 29	30 3	34 4	31 3	24 11	30 3	27 6	17 5	21 8	19 7
Apl. 5	30 4	34 10	31 4	24 7	30 9	27 0	17 7	21 11	19 2
,, 12	30 3	35 4	31 3	25 2	30 2	27 8	18 3	22 1	19 2
,, 19	30 4	36 7	31 6	25 5	29 11	26 11	17 10	22 4	18 10
,, 26	30 11	37 10	31 8	25 5	30 4	26 7	18 3	22 9	19 3
May 3	31 4	38 1	32 2	25 7	30 2	25 11	18 6	23 1	19 6
,, 10	31 8	37 11	32 6	25 1	31 1	25 9	19 0	23 7	19 6
,, 17	32 6	37 8	32 10	25 4	31 2	25 4	19 2	23 7	19 9
,, 24	32 8	37 2	32 10	25 0	31 1	25 3	19 5	23 7	19 11
,, 31	32 5	36 10	32 7	24 10	30 0	26 1	19 5	23 9	20 1
June 7	32 4	36 11	32 10	25 7	29 11	26 2	19 7	24 0	19 8
,, 14	32 3	37 0	32 8	23 11	30 8	24 7	19 8	23 10	20 2
,, 21	31 11	37 5	32 8	23 9	30 8	23 10	19 10	24 0	19 8
,, 28	31 10	37 10	32 8	24 5	30 2	24 3	19 9	23 11	19 1
July 5	32 1	38 2	33 1	25 10	31 7	25 2	19 9	23 11	21 0
,, 12	32 3	38 3		25 10	30 2		19 11	24 1	
,, 19	32 5	38 10		24 3	30 9		19 5	24 8	
,, 26	32 5	38 9		23 8	30 9		19 7	23 4	
Aug. 2	32 0	38 4		24 4	28 6		18 2	22 2	
,, 9	31 6	39 2		26 9	30 7		18 0	22 4	
,, 16	31 6	38 2		27 8	28 3		17 10	21 8	
,, 23	31 8	35 6		28 10	28 1		18 0	20 10	
,, 30	31 7	34 10		28 4	28 6		18 3	20 8	
Sept. 6	31 10	35 1		28 4	29 9		18 1	21 8	
,, 13	32 0	33 5		29 0	29 0		18 5	20 5	
,, 20	32 4	32 7		29 11	29 6		18 9	19 10	
,, 27	32 6	31 7		30 5	29 9		19 1	19 5	
Oct. 4	32 7	31 8		30 9	29 7		19 5	19 8	
,, 11	32 9	31 10		31 0	30 4		19 10	19 5	
,, 18	32 9	32 2		31 5	30 11		19 11	19 9	
,, 25	33 1	33 1		31 7	31 6		20 6	19 10	
Nov. 1	33 4	33 4		31 10	31 10		20 8	20 1	
,, 8	33 4	33 1		32 7	31 11		20 11	19 11	
,, 15	33 1	32 10		32 10	31 2		21 0	19 9	
,, 22	33 0	32 1		33 5	30 11		20 10	19 11	
,, 29	32 10	31 9		33 10	30 8		20 11	19 8	
Dec. 6	32 9	31 0		34 0	29 11		20 9	19 6	
,, 13	32 11	30 8		33 5	29 2		20 9	19 3	
,, 20	32 9	30 7		33 5	28 11		20 8	19 1	
,, 27	33 0	29 10		33 4	28 6		20 7	19 2	

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1912.	1913.	1912.	1913	1912	1913.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	May	52 8	49 8	30 9	30 1	24 6	24 0
	June	54 5	48 10	31 2	29 11	24 11	23 9
Paris:	May	54 0	51 1	29 9	30 2	25 2	23 0
	June	56 1	49 11	29 11	30 8	25 5	23 5
Belgium:	April	38 0	35 3	31 10	29 11	26 3	22 9
	May	39 4	36 1	31 9	29 8	27 0	23 2
Berlin:	April	48 9	44 3	—	—	28 0	22 11
	May	49 6	44 8	—	—	28 0	22 11
Breslau:	April	43 9	38 5	—* / 30 6†	26 8* / 25 3†	26 4	20 10
	May	44 10	39 2	—* / 31 11†	26 8* / 25 3†	26 4	21 0

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of June, 1912 and 1913.

—	Wheat.		Barley.		Oats.	
	1912.	1913.	1912.	1913	1912.	1913.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London	38 5	34 3	—	27 3	25 9	21 1
Norwich	36 10	33 8	30 8	24 2	23 11	17 9
Peterborough .. .	36 10	31 3	29 9	23 6	23 8	17 8
Lincoln	36 6	32 0	30 2	—	24 0	19 11
Doncaster	36 5	31 4	29 8	—	23 7	19 9
Salisbury	36 8	32 3	31 7	24 1	24 2	20 6

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in June, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb	per 12 lb.	per 12 lb	per 12 lb.	per 12 lb.	per 12 lb.
British ...	14 3	13 3	—	—	12 6	11 3
	per cwt.	per cwt	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	113 6	109 6	109 0	107 0	113 0	109 6
,, Factory ..	100 6	94 6	100 6	93 6	105 0	101 0
Danish	—	—	119 0	116 6	117 0	115 6
French ...	—	—	—	—	114 0	109 6
Russian	104 0	98 0	103 0	100 0	103 0	99 6
Australian	111 6	105 0	—	—	107 6	105 6
New Zealand	117 0	115 0	—	—	116 0	114 0
Argentine	108 0	104 0	—	—	106 0	104 0
CHEESE :—						
British—						
Cheddar ..	74 0	65 0	74 0	70 0	67 6	64 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire . ..	—	—	64 0	60 0	73 0	67 6
			per cwt	per cwt.	per cwt.	per cwt.
Canadian	62 6	59 6	63 0	61 6	61 0	59 6
BACON :—						
Irish	83 6	80 0	82 0	74 6	84 0	81 6
Canadian	75 6	73 0	73 0	70 0	76 6	74 6
HAMS :—						
Cumberland .. .	—	—	—	—	120 0	111 0
Irish	—	—	—	—	116 0	112 0
American (long cut) ...	86 0	81 0	85 0	81 6	85 6	83 6
EGGS :—	per 120.	per 120	per 120.	per 120.	per 120.	per 120.
British	9 4	—	—	—	10 2	9 2
Irish	9 3	8 9	9 2	8 4	10 1	8 9
Danish	—	—	—	—	10 1	8 9
POTATOES :—	per ton	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	120 0	100 0	—	—	110 0	100 0
Up-to-Date . .	120 0	105 0	121 6	117 6	113 6	100 0
Other late varieties ..	120 0	90 0	—	—	100 0	91 6
HAY :—						
Clover	100 0	90 0	100 0	80 0	119 6	111 0
Meadow	90 0	70 0	—	—	105 6	92 0

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	June. 1913	June. 1912.	Six Months ended June. 1913.	Six Months ended June. 1912.
Anthrax:—				
Outbreaks	35	43	317	497
Animals attacked	39	49	342	557
Foot-and-Mouth Disease:—				
Outbreaks	—	4	—	4
Animals attacked	—	38	—	38
Glanders (including Farcy):—				
Outbreaks	11	14	86	87
Animals attacked	20	32	244	185
Parasitic Mange:—				
Outbreaks	164	141	1,664	2,100
Animals attacked . .	305	297	3,379	4,657
Sheep-Scab:—				
Outbreaks	1	1	121	162
Swine-Fever:—				
Outbreaks	239	310	1,230	1,797
Swine Slaughtered as diseased or exposed to infection ...	2,535	4,110	17,037	22,841
Tuberculosis:—				
Number of Premises notified	582	—	*1,087	—
Number of bovine animals notified as for slaughter	641	—	*1,209	—

* Since 1st May, when the Tuberculosis Order came into operation.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	June. 1913.	June. 1912.	Six Months ended June. 1913.	Six Months ended June. 1912.
Anthrax:—				
Outbreaks	—	—	—	2
Animals attacked . .	—	—	—	2
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	5	6	92	45
Sheep-Scab:—				
Outbreaks	31	6	319	257
Swine-Fever:—				
Outbreaks	13	16	85	137
Swine Slaughtered as diseased or exposed to infection ...	73	125	503	1,275

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AUGUST, 1913.

THE GROWING OF LINSEED FOR FEEDING PURPOSES.

In order that the dairy farmer may produce milk most economically, and realise the maximum return on invested capital, it is imperative that he should (amongst other things) maintain a deep milking strain of cows. As a means to this end the rearing of the heifer calves from his best animals is all-important. Furthermore, it is desirable that as large a number as possible of calves of the beef type should be reared for fattening purposes. In view of the great and ever-increasing demand for milk, and its consequent high price, its use as an economical food for calves is an impossibility. Skim milk may be employed, but a substitute for the fat is necessary. Linseed as a source of easily digestible fat at once suggests itself, but at current winter prices it is an expensive food. The question therefore arises—can the farmer produce linseed at less cost than he can buy it? From experiments which have been conducted, it would appear that this question can be answered in the affirmative. Indeed, there is evidence to show that it may be grown profitably for sale.

In some parts of the world flax is grown for seed only, and in other parts for fibre (seed being a secondary consideration), but the object at which the British stock farmer should aim is probably the production of a full crop of seed together with a fair quality fibre. This is the system in reference to which the following suggestions on cultivation are given.

Kinds.—There are upwards of 100 species of linseed, but in many cases the differences are so slight as to be of

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botanical rather than economic interest. So far as the practical farmer is concerned there is only one cultivated industrial species, viz., *Linum usitatissimum*. A perennial form of linseed exists having a blue flower and black seed of doubtful value; it might, however, possibly be greatly improved by crossing and selection, with a view to its growth by stock farmers having low hill land.

Soil.—Flax grows on a wide range of soils of varying fertility. Those best suited to its culture are deep, moist, medium loams which are well drained and in a good condition of fertility, overlying rather heavy, compact subsoils. In favourable seasons, when heavy bean soils can be reduced to a fine tilth, excellent crops can be grown. Calcareous soils, on the other hand, seem to have a stunting effect on growth. Although the class of soil and its fertility are important determining factors, the preparation of the land as it affects mechanical condition is also of great significance.

Rotation.—The importance of a suitable rotation is fully appreciated on the Continent. Many different rotations are adopted, but all agree in not including flax too frequently. Authorities differ as regards the exact time which should intervene between two flax crops in the rotation; on an average seven years is the period allowed. Examples of rotations are:—

Belgium.—Clover, wheat, rye, potatoes, wheat, oats, flax with clover.

Holland.—Oats, wheat, potatoes, oats, flax, oats with clover and grass seeds, hay, grazed for two years.

Since linseed requires a clean seed-bed, it may be advisable to take it after a root crop, but excellent crops are often grown after a heavy oat crop, which leaves a clean stubble. If the soil is rich, flax may follow oats, if poor, it is sometimes taken after clovers. It may be sown by itself or with clover seeds, which, according to some authorities, do better with flax than with any other crop.

Preparation of the Soil.—A fine, clean, compact seed-bed is required. This allows of the seed being covered to a uniform depth and also permits uniformly rapid germination, this being very important. In order to secure this the land should be autumn ploughed to a depth of seven to eight inches. In

spring, if the soil is of a heavy nature a shallow ploughing three to four inches may be necessary, but grubbing and cultivation followed by harrowing and rolling will generally give the desired result. A farmer may find, however, that owing to the peculiarity of the season or because of economic or other conditions, *e.g.*, sheep feeding on green crop, he is unable to sow some of his intended cereal "break" with spring corn. In this case, if a suitable seed-bed can be obtained after the crop has been eaten off, a few acres of linseed may be sown instead. Compactness is an important feature of the ideal seed-bed, as it allows of the ascent of water from the lower strata to the somewhat shallow root system of the crop. The soil should be worked deeply and then consolidated, especially in the drier localities, in order that it may maintain all through the growing period a sufficiency of moisture and so allow of a full development of seed. On no account must the seed-bed be loose and friable.

Manuring.—Land must not be in too high condition, or the crop is liable to "lodge." Farmyard manure is most suitable when applied to the crops preceding flax, especially if a good quality fibre is desired. If applied directly, and this is admissible in the case of seed production, it should be well rotted. In a fresh state it causes a too luxuriant growth, which increases the possibility of "lodging," and tends to encourage weeds, thereby increasing the cost of subsequent cleaning. Since flax has a short period of growth and a comparatively small root system, the food material should be in an available state. Excellent results can be obtained by the judicious use of artificial manures. Potash is the chief artificial manure used for fibre production, as it checks "yellowing," a disease which attacks the plant in the early stages of its growth. The Department of Agriculture and Technical Instruction for Ireland recommend its application in the form of 5 cwt. kainit or 1½ cwt. muriate of potash per acre.

For seed production the following is suggested:—½ to ¾ cwt. sulphate of ammonia, 3 cwt. of superphosphate, and ½ to ¾ cwt. of muriate of potash per acre, applied immediately before seed sowing. It is the general opinion of farmers that flax is an exhausting crop, but this is not borne out by experiment. It is not a more gross feeder than wheat, and in some

cases better crops of wheat have been got after flax than after wheat.

Variety to Sow.—Too much care cannot be taken in the selection of the proper type of seed to grow. Russian seed and Russian seed grown one year in Holland have given very good results in the South of England. In order to test the seed- and straw-producing powers of different types of flax some twenty-three lots exported from various ports and supplied by the Seed Crushers' Association were grown at the Experiment Station of the East Anglian Institute of Agriculture last season. The soil is a heavy loam in good heart and received the following mixture of manures per acre:—

7 tons of farmyard manure.
½ cwt. sulphate of ammonia.
2 cwt. superphosphate.
½ cwt. steamed bone flour.
½ cwt. sulphate of potash.

The seed was drilled on May 10th at the rate of 1¼ bushels per acre and to a depth of 1 inch. Harvesting took place about the middle of August.

The following table gives the source of the seed, and the yield of seed and straw per acre:—

Source of Seed.	Yield of Seed per acre.		Yield of Straw per acre	
	cwt	lb	cwt	lb
Berdiansk (South Russia)	18	46	32	16
Kustendji (Roumania)	18	9	32	91
Marioupal (South Russia)	18	9	31	53
Nicolaieff („)	17	8	30	90
Braila (Roumania)	16	45	30	15
Odessa (South Russia) ...	16	8	29	52
Ghenitchesk („) ...	16	8	28	14
Morocco	14	82	22	86
Theodosia (South Russia)	14	82	26	88
Novorossisk (Russia) ...	14	44	27	88
Riga („) ...	14	44	34	92
Steepe („) ...	13	44	25	51
Konigsberg (Germany) ...	13	6	26	88
Turkey	12	81	28	14
Windau (North Russia)...	12	43	28	14
Libau („)...	12	43	26	88
Memel („)...	12	43	26	88
Calcutta	12	6	10	80
Bombay	12	6	10	80
Reval (North Russia) ...	11	5	25	50
Japan	10	80	20	10
Eupatoria (South Russia)	10	42	13	81

The length of the straw in the different varieties ranged from 10 inches in varieties from Bombay and Calcutta to 3 feet in the variety from Riga. The relative lengths were as follows:—

Length of Straw.	*Variety.*
2 ft 6 in. to 3 ft	Riga.
2 ft. to 2 ft 6 in.	Windau, Memel, Konigsberg, Japan, Reval.
2 ft.	Theodosia, Braila, Ghenitchesk, Novorossisk, Odessa, Kustendji, Nicolaieff, Marioupal, Berdiansk.
1 ft 6 in. to 1 ft 10 in.	Morocco, Turkey.
14 in	Eupatoria.
10 in. to 12 in....	Bombay, Calcutta

It will be seen from the table that although Roumanian and some South Russian sorts were best, good yields were obtained from all the varieties.

Calcutta, Bombay and Eupatoria sorts gave a very short straw, necessitating the pulling of the crop by hand, and their yield of seed was low compared with other varieties.

Chinese linseed was also sown. It produced a large amount of foliage and reached a height of 2 feet, but was a failure, as the plants "lodged" readily after rain and the seed never ripened. The seed produced by the varieties in the table on p. 380 was of excellent quality, as will be seen from the following statement showing the percentage of oil, albuminoids, and soluble carbohydrates present:—

	Calcutta	Morocco	Odessa	Steepe	Turkey.	Berdiansk.
Oil	36·13	38 36	39 65	30 23	35·09	30·26
Albuminoids	22·12	23 00	23 50	20 81	22·12	21·56
Soluble Carbohydrates	18 36	19 49	18 58	17 31	18 65	19·52

In 1911 Riga seed was sown and the resulting seed analysed, when the oil content was found to be 35 66 per cent. This seed, grown one year in Essex, was sown in 1912, when it produced seed containing only 26 73 per cent. of oil. In view of this fact, it would appear that a change of seed should be resorted to frequently. Too much importance, however, must not be placed on this result of one year's experiment, further investigations on this point being necessary. Apart from the question of source of seed, it is very important that the sample should consist of plump, well-developed seeds of good colour, and be free from weed seeds. It should be

remembered that linseed absorbs moisture readily and thereby loses its vitality; it must therefore be kept in a cool, dry place.

Chaff.—9 to 12 cwt. of chaff may be obtained. This consists essentially of the remains of the seed bolls after the seed has been threshed out. It is fed with good results in conjunction with other dry foods, *e.g.*, oats, bran, &c., to ewes, which eat it with avidity. Ewes with lambs, however, should not be supplied with it, as the large amount of fibre which it contains renders it quite unsuitable for young stock. When supplied at this time it has been the cause of a considerable number of deaths amongst lambs in different flocks.

Time of Sowing.—No special time of sowing can be suggested, owing to diversity of climate and season. It is held by many that linseed is killed by frost, but white frost has been seen on linseed plants, which were not in the least harmed and ripened perfectly. It may be advisable, however, to delay sowing until all likelihood of frost is past. It is sown from April to the middle of May; perhaps the beginning of May is the best time. If the seed is sown late and drought sets in, the crop will be stunted.

Method of Sowing.—Either broadcasting or drilling may be practised. In districts where the best fibre is produced the former method is adopted. The seed, being flat and smooth, runs readily from between the fingers, and care is required to give a uniform distribution. When the seed is drilled the outermost plants in the drills branch more than those towards the centre, and this is fatal to the desired uniformity in the fibre. Where it is grown for seed, drilling may be conveniently adopted. This method means not only a saving of seed, but of weeding, and after-cultivation can be practised. An ordinary corn drill may be used, the coulters being set about eight inches apart.

Rate of Sowing.—For seed production a satisfactory "plant" will be obtained on tilthy land by broadcasting 70 to 80 lb. or drilling 40 to 60 lb. per acre. If sown too thickly the plants will be crowded, and on each plant only one or two seed bolls with poorly developed seeds may develop. Seed production demands strong branching plants with large leaf surfaces, and plenty of aeration. Thicker seeding is practised for fibre production, as much as 3 bushels (156 lb.) per acre being sown in some districts.

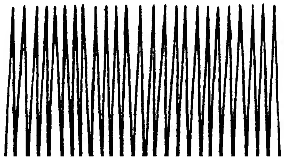
Depth of Sowing.—In order to obtain a uniform sample of seed at harvest time, it is most important to have all the seeds covered to the same depth. This can be secured by drilling on a uniformly fine compact seed-bed obtained in the manner already described. If buried too deeply, most of the seed energy is expended before the leaf is formed, the result being a dwarfed crop. The depth which gives the best results is ½ inch to 1 inch. The seed should be harrowed in with a light iron harrow having closely set teeth, and then rolled.

Weeding and After-cultivation.—It is well to take flax after a cleaning crop or at least to sow it on clean land. Good farming is the great preventive of weeds, and perhaps no crop shows the advantages which accrue therefrom more than flax. The presence of weeds not only lessens the amount of food material available for the flax plant, but hinders the curing and drying of the seed bolls at harvest time, and reduces the selling value of both seed and fibre. When the crop is drilled one hand-hoeing may be given. All pulling of weeds should be done when the soil is fairly moist, or the flax may be uprooted or have its roots exposed. Deep-rooted plants like thistle and dock should be spudded. Convolvulus and dodder are perhaps two of the most troublesome weeds in the flax crop. Care should be taken that the seed sown does not contain the seeds of these plants. All plants noticed to be affected with dodder should be pulled up and burnt before the parasite has time to flower. (See the Board's Leaflet No. 180.)

Harvesting.—If the seed is sown about the end of April or the beginning of May, the crop will be ready for harvesting in August, three to four months being required according to the season. The seed should then be plump, well developed, bright, and brown in colour. It may be reaped a little before it is quite ripe, as it matures in the "shock" like wheat. The crop may be pulled by hand or, where suitable varieties have been sown, cut with hook or reaping machine. The fibre, however, is much more valuable from a crop which has been hand-pulled, as a longer fibre is then obtained. If a reaping machine is used, the knife must be very sharp, the teeth on the cutting board fairly close, and the crank action quick. This allows of clean cutting being done with the minimum

of trouble and at the least cost. When the reverse conditions exist the process is one of "chewing" rather than cutting, and unsatisfactory work is the result. The sheaves, which should be small, to allow of rapid curing, are "shocked" in the ordinary way. In order to lessen the risk of injury from wet and of losing seed in subsequent handling, the crop should be carted directly it is fit. Cloths should be spread on the floor of the cart to catch any bolls which may be broken off.

Threshing.—If only a small area of flax is grown the crop may be threshed with a flail. This separates all the bolls from the straw, and breaks the majority of them, but a considerable number will be left unbroken. Further breaking can be done by running a garden roller over them, when the seed can be separated from the chaff by passing it through a



RIPPLING COMB

winnowing machine. Another method is to pull the straw through a rippling comb, which removes the bolls, when these can be crushed with a roller. Satisfactory results have also been got by passing the unthreshed straw through a mangle, which breaks the bolls and allows of the seed being readily knocked out. If one of these methods is adopted the straw is not broken or destroyed. Where a comparatively large acreage is grown, resort may be had to the ordinary threshing machine, which, however, does not, as a rule, do very good work. To ensure the best results it should be set as close as possible and be maintained at a high speed. The straw in this case is not so valuable, as it is broken up by the drum.

Value of the Straw.—The straw makes excellent packing material for crockery, and in some districts it might meet a

ready sale for this purpose. On the farm it is very useful for thatching purposes, and being very tough it lasts for a considerable time. Good qualities are used in some districts for the manufacture of coarse sacking and binder twine, while the broken material is made into tow. A machine patented by a German firm has recently been constructed capable of spinning the somewhat short fibre which is obtained from the straw. This fibre is chiefly used for the manufacture of fine paper such as parchment. If the straw is properly dried and evenly put up it would be worth for retting purposes £2 to £4 per ton, according to length and quality delivered at the rettery. It is essential, however, that the quality should not be impaired during the drying process and that the straw should be kept quite straight and even in the sheaves. This can be accomplished if flailing is the means of threshing adopted or if the seed is removed by introducing only the upper end of the straw into the drum of the threshing machine.

Summary.—The following advantages are derived from the growing of linseed:—

1. As a food for stock it can be grown more cheaply than it can be purchased on the open market, and calves may be more economically reared.

2. It allows of the profitable employment of land which, owing to lateness of the season, cannot be sown with spring corn.

3. In a dry early season it can be removed in time to allow of a catch crop being taken.

THE EFFECT OF WATERY FOODS ON MILK.

IN reviewing the literature which has appeared during the last twelve years or so on the effect of watery food on the production and quality of milk one is confronted with many puzzling and conflicting statements.

Twelve years ago the popular idea was that the quantity and character of the milk could be largely affected by causing the cows to take water in excess, whether through the medium of their food or otherwise. The conflicting character of the evidence on the point is, no doubt, largely due to the diffi-

culty of eliminating factors other than those the influence of which it is desired to ascertain. The popular idea notwithstanding, we find the following statement in Bull. 197 of the New York Agricultural Experiment Station (1901): "It is important to inquire whether the quantity and character of the cows' product were in any way modified by the unusual character or variation of the rations. The inquiry is all the more pertinent because of the prevailing notion, not yet justified by any researches whatever, that the composition of the ration determines to a large extent the character and composition of the milk."

In the year 1903 Professor Gilchrist, of Armstrong College, published a report on an inquiry into the variations in the composition of milk (see Reports on Dairy Investigations at Offerton Hall, Durham, 1909), in which he gives an interesting account of his observations on the results of change of food. The changes in the rations were as follows:—

Each cow received daily—

March 4th—10th { 86 lb. mangolds
20 ,, hay
10 ,, linseed cake

On March 11th a compound cake was substituted for the linseed cake. The change produced no alteration in the yield and quality of milk.

A fortnight later a further change in which 6 lb. of another compound cake with 4 lb. of maize and oatmeal were used as concentrated food produced no effect on the milk. On April 23rd the supply of mangolds was reduced to 50 lb., but the yield and quality of milk remained the same. Even a complete withdrawal of the mangolds a week later caused no change. On May 9th the cows were turned out at night, the weather being mild. After being turned out they received nothing but grass. Even such complete change of conditions produced scarcely any result in the quantity and quality of the milk.

Writing in 1906 Dr. Lauder (Bull. 11, Edinburgh and East of Scotland College of Agriculture), in discussing the influence of feeding on the composition of milk, expressed the opinion that the general belief is that it is impossible to effect more than a temporary change in the quality of milk by feeding. Some figures incidentally obtained are given in

support of this view, which is also supported by Jordan and Wheeler (New York State Station, 1907), who held the view that the quality of the milk is determined by the individuality of the animal, and not by the character of the food, and that neither drinking water nor watery food can influence the amount of water in cow's milk.

In 1907 was also published Offerton Bulletin No. 2, which embodies the reports on two experiments to test the effect of (1) feeding of concentrated food on pasture; and (2) that of brewers' grains on milk.

On the first point Professor Bryner Jones concluded that there seemed to be no advantage in using concentrated food on good pasture:—"The quality," he says, "is mainly dependent upon the character of the cows, and provided the animals receive adequate nourishment, no increase in the ration is likely to affect the quality to any appreciable extent."

As regards the second point, the following conclusions are given:—

(1) A moderate allowance of brewers' grains produces a material increase in the yield.

(2) The exact duration of the effect was not determined, for the experiments did not cover a sufficient length of time.

(3) There seemed to be indications that brewers' grains given during the early portion of the lactation period tend slightly to reduce the percentage of fat. Towards the end of the lactation period the effect in that direction is inappreciable.

(4). Brewers' grains produced no effect on the solids-not-fat.

(5) The best time to feed brewers' grains is when the period of lactation is well advanced, for the percentage of fat in milk is then greater than earlier in the lactation period

This bulletin contains an important suggestion to the effect that brewers' grains produce a specific physiological action which may account for the increased milk yield consequent upon their use.

Two further experiments to test the effect of moderate quantities of brewers' grains on the yield and quality of milk were conducted under the direction of Mr. F. P. Walker, Armstrong College. The conclusions from these corroborative experiments are given in the Offerton Bulletin No. 3, and agree, in the main, with those given in Bulletin No. 2. Several points are emphasised as, for example:—

(1) The period over which the effect of the brewers' grains lasts has its limits, and it is good practice to exercise a change of diet.

(2) The daily average of fat is not, in the long run, appreciably diminished.

(3) There is a tendency, nevertheless, for the percentage of fat in the morning milk to be lowered, and brewers' grains are not recommended when the morning milk is habitually dangerously near the 3 per cent. minimum.

Elaborate experiments were carried on by Professors Tangl and Zaitschek with a view to testing the influence of different watery foods on milk secretion, and their conclusions and observations, embodied in a lengthy report (*Die landw. Versuchs-Stationen, Band LXXIV., Heft* iii–v., 1911), are summarised as follows:—

(1) The ten cows experimented with received abundant protein and approximately the same starch equivalent. When on watery foods their live weight increased 0·55 kg. per day, and when on dry foods 0·60 kg.

(2) While those cows which were fed on brewers' wash (*Schlempe*) and pumpkins took practically no drinking water, those fed with roots, potatoes, and lucerne drank a significant amount.

(3) On the average, the water consumption during the watery food period was about 30 per cent. higher than when dry food was given.

(4) With the advance of the lactation period the percentages of solids increased significantly, with the exception of milk sugar, which remained almost constant The proteid and fat content increased more rapidly than the ash content.

(5) On the average, there was no difference in the composition of the milk obtained whether from watery or dry foods; it is not true that watery foods produce a thinner milk than do dry foods.

The increased water consumption due to giving watery food caused no change in the milk, nor did it affect the milk yield.

(6) The individual watery foods, on the contrary, influenced the quantity of milk in various ways. The brewers' wash (*Schlempe*), roots, and lucerne raised the milk yield; the potatoes somewhat diminished the yield; while the pumpkins greatly reduced the quantity.

(7) The milk yield depends not only on the amount of digestible foodstuff consumed and on the starch equivalent, but also on the quality of the food.

In 1910 special attention was drawn to the importance of the subject of adulterating milk by the conviction of a dairyman in the French Courts for selling low-grade milk. As was pointed out in this *Journal* for February, 1911, the conviction was based on the belief that milk can be watered indirectly through the mouth of the cow. As a result of this conviction and to obviate any injustice, the Board of Agriculture and

Fisheries entered into negotiations with the Agricultural Education Association with a view to arranging a carefully conducted experiment to test the matter. A short account of the experiment, which was carried on at the Midland Agricultural and Dairy College, was published in the issue of this *Journal* referred to above. Seven cows were taken for the test. Their ration consisted of concentrated and dry foods and mangolds, and every seventh day the food of each cow was salted with the intention of causing thirst and consequent excessive drinking. Briefly stated, the result of this experiment showed (1) that salt administered even in excessive doses does not necessarily induce excessive drinking, and (2) that the quantity of the water drunk by cows has no direct effect upon the quality of the milk. In *The Dairy* for April 15th, 1911, Mr. Primrose McConnell comments on this experiment in general terms, thus:—"To the present writer the experiments do not seem to have gone far enough. It is a matter of common knowledge that the lush grass of spring, an excess of mangolds, or too many brewers' grains will promote a great flow of milk, but that that milk will be poor, and farmers who do not do anything to modify such feeding will find their milk coming dangerously near the standard."

An interesting report was issued in 1911 (*Die landw. Versuchs-Stationen, Band LXXIV., Heft* iii–v.) on the use of molasses as a condiment in food and its effect on milk secretion. The experiments do not deal directly with the subject of this article, but in view of certain deductions to be drawn later the following short summary of results is given. The addition of molasses to unappetising foods raised the milk yield by nearly one-half, the quantity being practically the same as that obtained from palatable stuffs like hay, brewers' grains, &c. Molasses contains materials which, apart from their content of digestible foods, have a considerable influence on milk secretion. The poorer the fundamental ration in sweet-tasting or sweet-smelling materials the more marked was the effect of molasses in the food.

In a paper read at the meetings of the British Association at Dundee and incorporated in Report No. 26 of the Edinburgh and East of Scotland College of Agriculture, Lauder

and Fagan give an account of experiments extending over three years which were conducted partly to test the effect of a ration consisting largely of roots on the yield and composition of milk. Three separate experiments were carried out. After a preliminary trial to complete the grouping of the cows experimented with they were gradually put on to the experimental rations. In the second and third experiments after the experimental rations had been fed for two months or more the rations were gradually crossed and the new arrangement adhered to for another four or six weeks.

Taking the results of the three experiments together, the following conclusions were drawn:—

(1) The feeding of a ration containing a large quantity of water does not increase the percentage of water in the milk or reduce the percentage of fat.

(2) In all three experiments the greater yield of milk was obtained from the cows on the concentrated ration. On the other hand, the milk from the cows on the turnip ration contained a higher percentage of fat, and a greater total weight of fat was secreted in the milk."

Hansson, of the Stockholm Agricultural Experiment Station, has reviewed (*Fuhling's landw. Zeitung*, May 15th, 1912) the work of various experimenters during the last few years as to the effect of the various foodstuffs on the milk yield of cows and its fat content. He concludes that there are distinct differences between various foods in these respects, but that the specific effect of any food varies with varying circumstances, *e.g.*, it depends on the kind of cow and upon the composition of the other ingredients with which the food is employed. He, however, gives lists of foods indicating their tendency with regard to milk secretion and fat content. Roots are included among foods which are stated to have a favourable effect on milk secretion, but tend slightly to lower the fat content.

There remains one other report to be considered. It deals with the Specific Effect of Foods on Milk Production (*Die landw. Versuchs-Stationen, Band LXXVII., Heft* i., u. ii., 1912), and contains an account of experiments carried out at the Hohenheim Station. The results obtained are compared with those of other experimenters. The conclusions arrived at are:—

(1) That many feeding stuffs have a specific effect on milk production.

(2) That this specific effect may alter (*a*) the quality and (*b*) the yield of milk.

(3) The effect is chiefly attributed to stimulating substances in the food. Included among them are substances with pleasant smell and taste, with no smell (*e.g.*, salt), and non-albuminoid nitrogen compounds; in fact, all substances which have physiological effects, but which are present in feeding stuffs in such small quantities that their effect as nutrients is negligible.

On examining and comparing the conclusions drawn from the various experiments there are several points which appear to emerge. The general view of those who have studied the subject seems to be that excess of drinking water does not appear to have any effect whatever upon either the quantity or quality of milk. Special attention was given to this question in the experiment organised conjointly by the Board and the Agricultural Education Association in 1910. It seems, therefore, unreasonable to expect water administered in any other form to have any effect on the yield and composition of milk. The experiments cited show that there are certain watery foods (such as roots) which appear to have no very pronounced effect on the milk, while others, such as pumpkins, reduce the secretion materially. Still others (brewers' grains) have, by general consent, a marked stimulating effect. It would appear, then, that the water content of the food as such has but little influence on either the quantity or quality of the milk. It is one or more of the other ingredients of the food—not necessarily nutrients in the ordinary sense—which are responsible for the variation in the output and fat content of the milk. It was pointed out in the Offerton Bulletin No. 2 that brewers' grains might have a physiological effect resulting in increased flow. This is an important conception worthy of further attention.

In this connection experiments made by Dr. Hopkins, of Cambridge, on some new developments in the physiology of animal nutrition must be mentioned. He has shown it to be doubtful whether the nutritive value of various food materials can be expressed in terms of their energy value as measured by their starch equivalent. His experiments with the protein Zein show that substance to be, by itself, incapable of sustaining life. The addition of a little of the amino-acid

tryptophane, however, renders it quite suitable. Dr. Hopkins' experiments on the feeding of mice on compounded rations are most instructive and suggestive. Certain compounded rations proved quite incapable of maintaining life, but the addition of the merest trace of milk—a quantity quite negligible so far as its nutritive value went—rendered these mixtures quite capable of sustaining the mice. Dr. Hopkins discovered as long ago as 1907 that there is present in milk (in quantities of less than 0·1 per cent.) a substance—not a protein—which may be of the nature of a catalyst or enzyme, and which is absolutely necessary for growth. Along these lines appears to lie the explanation of the conflicting opinions as to the effect of watery foods on milk secretion.

The conclusions in two or three of the papers mentioned above rather uphold this contention. In the experiment on the use of molasses as a condiment it was concluded that molasses contained materials which, apart from their nutritive value, had a considerable effect on milk secretion. Further, Hansson concluded that the specific effect of a food varies with such circumstances as the composition of other ingredients with which it is employed. Lastly, it is concluded in the final experiment alluded to above :—

(1) That many feeding stuffs have a specific effect on the yield and quality of milk; and

(2) That this effect is to be attributed to stimulating substances in the food—substances which have physiological rather than nutritive effects, and which are present in foods in small quantities only.

As has already been pointed out, it is difficult to eliminate factors other than the one the effect of which it is desired to investigate. The water in the food may be associated with substances which produce physiological effects resulting in an increased yield of milk, but care must be taken not to attribute such an increase to the influence of the water in the food. This mistake appears to be largely responsible for the very conflicting views which obtain.

BOTANICAL CONSIDERATIONS AFFECTING THE CARE OF GRASS-LAND.

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Treatment of grass-land falls under two fairly distinct headings, namely, (1) meadows, to increase the current year's yield of hay; and (2) meadows and pastures, to improve their general condition. The first should be rightly considered as a tillage expense, and debited to the hay crop; the second should be regarded as capital expenditure, and therefore justifies a greater outlay than would be remunerative for a single crop. It is with the second of these categories that it is proposed to deal here, and the treatment will be discussed under two headings: (1) manurial, and (2) general husbandry.

In the first place, it will be necessary to consider in some detail exactly what constitutes the botanical condition of a field, how this may be best studied, and at what time of the year close inspection of grass-land will yield the most accurate botanical information.

Now the success or otherwise of any particular scheme of manuring for current purposes can be rightly gauged by weighing the cut produce of the manured area and comparing it with that from untreated areas; and comparative botanical analyses of the cut herbage (hay) will show what grasses have contributed most to the yield as a result of the treatment. Evidence thus obtained, however, will not give reliable information as to the lasting effect of manures on the general condition of grass-land—that is to say, it cannot be relied upon as an index of the best capital outlay. None the less, with but few exceptions * the botanical data so far collected on the effect of manures, and indeed on the general nature of grass-lands, have been obtained by this method. A method which only gives exact information concerning the relation of the top growth of the grass species to each other, and gives no information concerning the nature of the sward, or any indication of the nature of the root systems (the organs of

* See S. F. Armstrong's paper on the Botanical and Chemical Composition of Pastures and Meadows, which is an outstanding exception.—*Jour. Agric. Science*, Vol. II., Part 3.

the plants which collect and absorb plant foods, and therefore which directly utilise manures) of the contributing plants, supplies only an inaccurate idea of the prevalence of the clovers, and furnishes little or no information concerning the weed flora of a field. Moreover, such information as these analyses supply refers only to the late spring and early summer condition of a field.*

In order to gain a full knowledge of the botanical attributes which affect the productive value of a pasture or meadow, it is necessary to study in detail a number of more or less distinct but inter-related phenomena. These should be studied, moreover, not only with a view to ascertain the condition of any particular field in regard to each, but with the aim of discovering the nature of the factors which produce them.

Botanical Characters of Grass-land.

The nature of the phenomena chiefly demanding attention may be summarised under the following eight headings:—

1. The quality and quantity of the weed flora.

2. The quality and quantity of the leguminous flora, especially of Dutch clover.

3. The quality and quantity of the gramineous flora and the ratio of valuable to useless grasses—all the year round.

4. The condition of the useful plants in regard to the production of nutritious herbage.

5. The nature of the aggregate root system of the pasture or meadow.

6. The degree of productiveness of the several useful plants throughout the year.

7. The quality and quantity of the moss flora throughout the year.

8. The factors affecting the foregoing considerations, and their interrelations.

In order to appreciate the significance of the above enumeration it will be necessary to review briefly the state of our present knowledge concerning each problem, and to show how intensive studies may be made with a view to the elucidation of the different problems involved.

1. *The Quality and Quantity of the Weed Flora.*—The

* And late summer condition on the rare occasions when the aftermath is cut and analysed.

effects of weeds on pastures have only been very slightly studied. The harm done and the room taken up by such obvious weeds as Docks and Thistles (easily visible in the long grass in summer) have been emphasised. The competition that results from an excess of mat-like herbs such as Plantains, Daisies, Buttercups, Cat's-ear, and Hawkweeds, with their deep-going and extensive root systems, has not been fully appreciated.

Not only does an excessive miscellaneous herbage capture much ground at the expense of the valuable species, but evidence is not lacking to show that the nutritious plants are considerably hampered in their development by competitive interaction between their root systems and those of the weeds.

A large number of analyses made both on very inferior and on good pastures on the Cotswolds showed in practically all cases a great excess of weeds on the inferior as compared with the good fields. On an average of a number of analyses, the percentage of weeds in the good fields was 6 per cent., and in the inferior ones 15·9 per cent. Far profounder divergence than a mere statement of the percentage of weeds indicates is, however, usually manifest when fields are analysed with a special view to a study of their weed flora.

The spring and summer condition of meadows especially, but also of pastures, always tends to mask the ground flora (mat-like herbs and Dutch clover). Fields should be examined not earlier than the end of October, and up to the middle of March. November is probably the best month if an accurate estimate of the herbage is sought. Plantains, Daisies, Buttercups, &c., are all easily recognised at this period. For purposes of comparison, fields or plots should be analysed. This is easily done by employing a mesh 6 in. by 6 in. or 1 ft. by 1 ft., and taking a number of readings all over the field; then by counting the weeds only, an estimate of their number to the acre is easily made. Typical turfs should be lifted and some estimate made as to the root systems of the most abundant weeds. Two fields on the Aberystwyth College Farm were analysed in this way. The one was a good pasture, but not quite suitable for fattening purposes; the other was a meadow which has been gradually deteriorating and is now being treated as a pasture.

The good field showed half a million mat-herbs to the acre, the poor field nearly a million and a half. The percentage of Ribwort Plantain was the same in both cases (about 40 per cent.), but the number of plants of this weed was 229,000 on the good field against 546,000 on the poor one. This was estimated as representing 3·4 million feet of Plantain root system in the one case and 8·1 million feet in the other. The above example is given to show that the point to ascertain is not necessarily the percentage of the several weeds on a field, but their actual number; for, from the point of view of competitive interaction, it is the number of plants per unit of area that is the criterion. The writer's analyses have shown that weed estimation, in even slightly long grass, is unsatisfactory, thus corroborating what Hall and Russell say about Buttercups.* Indeed, we would go further and say that only the broadest generalisations about the weed flora are permissible from analyses made on cut herbage. This is especially true of manured plots, for, in the first place, by virtue of the increased bulk of grass on the manured compared with the unmanured plots, the percentage of the miscellaneous herbage naturally shows a falling off when calculated from the samples taken; but it must be pointed out that the samples are not representative, since the knives miss much of the plantain and similar leafage lying close to the surface, and these heavy leaves are not sufficiently gathered in taking samples. The consequence is that the effect of the several manures on the mat-herbs can only be gauged imperfectly by reference to the various published results of manurial experiments.

These reports none the less show a difference in the behaviour of weeds on the plots of different areas. All agree, moreover, in showing that sulphate of ammonia, either alone or with other manures, has the greatest depressing effect on weeds. Complete mineral dressings with nitrate of soda generally also have good results in this respect. The phosphatic manures alone, at Rothamsted at all events, have not had a marked effect on the weed flora. Analyses made on the

* Hall and Russell: "On the Causes of High Nutritive Value and Fertility of the Fattening Pastures of Romney Marsh and Other Marshes in S.E. England."—*Jour. Agric. Science*, Vol. IV., Part 4, p. 370.

spot on calcareous soils at the Royal Agricultural College, Cirencester,* have shown that phosphatic manures have, on these soils, little or no effect in decreasing the actual number of mat-herbs per unit of area, but that sulphate of ammonia (even one dressing) has a very real effect in thus actually depressing them. In view of the excess of weeds so often associated with poor pastures (20 per cent. or even 30 per cent. on the basis of the number of plants per unit of area being not an uncommon figure on inferior types), it would seem desirable to obtain accurate data from manurial plots in regard to the real behaviour of the weeds.

Analyses have further shown that, other things being equal, the mat-herbs tend to be most abundant on pastures and on meadows which only produce a thin and haulmy hay crop. These plants are sun-enduring—witness, for instance, the prevalence of Plantains, Daisies, Buttercups, &c., on cricket pitches, tennis lawns, golf greens, &c., where the sun has full play, or the large percentage of weeds, chiefly ephemeral annuals, which, as Tansley has shown,† occur on much heath-land. Weeds are also very prevalent on dry upland grass-lands, where such hay as is produced is necessarily thin and haulmy. Mat-herbs are also abundant on pastures, or in places on pastures where water has been stagnant through the winter; such habitats produce a very sparse amount of grass, which consequently casts very little shade. Mat-herbs and other weeds are also often very abundant in situations where much leaching by rain (without any return of silt) is the rule. In short, mat-herbs luxuriate wherever the grass does not grow, or is kept constantly and closely grazed down.

From the foregoing statement it appears that under natural conditions the mat-herbs are most abundant where, for one reason or another, nitrogen as nitrate is only slightly available. This, presumably, is due in part to the deficiency of nitrogen, and in part to the consequent poor development of fully herbaceous shade-giving grasses. Just in proportion as weeds gain on the land, so does nitrogen become increasingly less available to the grasses, which therefore become

* Kinch, Turner and Stapledon: "Manuring Experiments."—*Agric. Student's Gazette*, December, 1912.

† Tansley: "Types of British Vegetation."—Camb. Univ. Press.

less and less herbaceous, cast less shade, and allow of a greater development of the sun-enduring mat-herbs.

In conclusion, it should be pointed out that in order to gauge the relation between miscellaneous herbage and the productiveness of a grass field, it is necessary (*a*) to ascertain the kind and quantity of the weed flora by analyses made on the ground in November, and (*b*) to analyse the gramineous produce by the ordinary method of sorting and weighing from the hay crop in the summer, supplemented, however, by counting the inflorescences and by carefully comparing them and the herbage with samples of equal bulk taken from other sources.

(2) *The Quality and Quantity of the Leguminous Flora.*—The importance of Dutch clover on pastures, first emphasised by Fream and since substantiated by Middleton and Armstrong, is now a matter of common knowledge. It is well known that the phosphatic manures favour maximum production of the leguminous herbage, Dutch clover and bird's foot trefoil responding particularly well. On the thin soils of the Cotswolds, the meadow vetchling (*Lathyrus pratensis*) responds especially well to superphosphate. When analyses are made by the methods of (1) plants per unit of area, and (2) by sorting the cut herbage, it becomes evident that the former affords a more trustworthy guide to the relationship of the Leguminosæ to the rest of the flora. An extensive series of plot analyses by this method at Cirencester showed that full mineral dressings (*i.e.*, nitrogen, potash, and phosphate) do not as a rule decrease the leguminous herbage on these calcareous soils. The relation between habitat, on the one hand, and Dutch clover and its allies on the other, has not been sufficiently studied; during the severe drought of 1911 Dutch clover (even the endemic plant growing on natural habitats on the Cotswolds) suffered very much. Dutch clover is not usually abundant on water-logged and stagnant areas.

Bryner Jones has recently shown on the Aberystwyth College Farm the excellent effect on the production of Dutch clover of harrowing the land with a toothed harrow before applying basic slag. This is presumably due to the greater room given to the clover, and probably also to the consequent aeration of the soil. As stated above, long grass masks the

Dutch clover, which owing to its more rapid drying down, never bulks proportionally to its real abundance in samples of cut herbage. Analyses *in situ* should always be made. Early April is perhaps the most suitable time. Winter analyses are excellent if turfs are lifted and the root clusters are counted, the plant being only partially herbaceous in winter.

(*To be continued.*)

THE WOOL SALES OF 1913.

AT the beginning of June it became evident that prices of the new clip would be higher than last year, as the wool had been secured in very good condition, and growers had been more careful to meet the views of the Yorkshire trade by keeping the wool as clean as possible, although complaints were made that the unwashed wools contained more "clegs" than usual, especially in the Southdown district. The results of the first sales were awaited with great anxiety, as growers were very keen on obtaining advanced prices to compensate them for the two previous bad seasons. Reports of nearly all the principal sales were obtained by the Board and published in their Weekly Return of Market Prices.

At Sleaford, on the 14th, competition was fairly keen, and prices showed an advance of about 3*d.* per lb. over last year, the top quotation for Lincoln washed wool being 13¾*d.* per lb. As the sales advanced, prices became even firmer, and at the large fair at Leicester trade was very good, the average rise over last year's prices being estimated at fully 3*d.* per lb.; a feature of the trade was the fact that the same values were given for ewe as for hogg wool, and indeed at several later sales ewe wool realised even more money than hogg. The great sales in the West Midlands opened at Wellington (Salop) on the 18th, where about 75,000 fleeces were offered, the supply being rather less than last year, but the quality was good, and, although bidding was slow, prices ruled high, Shropshire wool making up to 16*d.*, and Southdown Cross to 16¼*d.* These prices were about maintained at Shrewsbury and Oswestry, but at Lichfield buyers seemed determined to purchase more cheaply, and quotations showed a fall of about

1*d.* per lb., many lots being withdrawn owing to the dissatisfaction of vendors. At Newport (Mon.), Cirencester and Gloucester supplies were small, and high prices were obtained, Southdown wool at Cirencester making up to 15¾*d.* for a very good lot, while Oxford Down averaged 14½*d.* per lb.

In the Eastern counties, the large sales at Colchester, Ipswich and Bury St. Edmunds resulted in a very brisk demand, with prices ruling about 2*d.* to 2½*d.* per lb. higher than in 1912, Suffolk Down washed making up to 15*d.*, and unwashed to 11¾*d.*, Southdown washed up to 15¾*d.*, and unwashed to 12*d.* per lb.

The south country sales commenced at Reading on the 28th, where over 13,000 fleeces were pitched; owing to the anticipated fall in prices at the London Colonial sales, quotations were not so high as at the early sales, the best lots of Hampshire Down washed making 14¾*d.* per lb. At the beginning of the next week, however, this fall in prices was recovered, and at Andover, on June 30th, Hampshire Down washed made up to 15½*d.*, and Southdown washed to 15¾*d.*, unwashed making 12½*d.* and 11¾*d.* respectively, while at Chichester the top price for Southdown washed was 16½*d.* per lb. At this sale the hogget wool was not so clean as usual, owing to the wet winter, and was cheaper than the ewe wool, whereas last year the reverse was the case. The largest sale in Hampshire was at Winchester, on July 2nd, when about 70,000 fleeces were offered, mostly unwashed wool; the lower prices at the London sales did not seem to affect the demand here, and prices ruled high, several Irish and Welsh buyers coming in and purchasing large quantities; Hampshire Down wool made up to 15¾*d.* washed, and 12*d.* per lb. unwashed, a complete clearance being effected. These prices were about maintained at Swindon, and even exceeded at the large sale at Salisbury, where buyers were very keen to purchase at an advance of fully 2*d.* per lb., compared with last year. The demand continued good at the Dorset sales, prices for Hampshire Down wool ranging up to 16½*d.* at Blandford, and to 16¼*d.* at Dorchester, the averages being 16*d.* and 15¾*d.* respectively for washed wool, while Dorset Horn wool averaged 16⅝*d.* at the latter sale, with an extreme of 17¾*d.* for an exceptional lot of 290 ewe fleeces. The wool at these two sales was in excellent condition,

and all lots were cleared. After this the demand eased off slightly, and prices for Hampshire wool were not quite so high at Devizes and Marlborough, but this was probably due to the fact that the quality of the wool was not so good.

At the early fairs in North Wales there was an excellent demand for Welsh mountain and Shropshire wool, and prices showed an advance over those current last year of *2d.* to *3d.* per lb. At Ruthin and Denbigh, Welsh washed wool made 11*d.* to 12*d.*, a few lots even making up to 12½*d.* per lb. at the latter sale. As the sales progressed, however, the demand slackened off somewhat, and prices became rather weaker; this became evident at the fair at Llandrillo, where sellers were disappointed at not being able to obtain more than 11*d.* per lb., especially as dealers had been through the district the previous week offering 11½*d.*: a clearance was, however, effected at the lower prices.

The chief closing sales of the season were held in Sussex and Kent. Prices for the Southdown wool did not make such an advance as for other wools, the rise at Lewes over last year's prices, taking into consideration the good quality of the wool, being estimated at ¾*d.* to 1*d.* per lb. At Ashford also prices were not so good as had been expected, although the demand was brisk; Kent ewe wool made 12½*d.* to 12¾*d.*, and teg wool 13*d.* to 14¼*d.*, while at Rye the top price was 15*d.* per lb.

Altogether the sales appear to have been very successful, the best fleeces having been in extremely good request all through the sales. Supplies were much smaller than last year, and a clearance was effected at nearly every sale; although it became evident after the first few sales that the great increase on last year's prices could not be maintained, there was a brisk demand all through, and the average advance may be put down at 2¾*d.* for Lincoln, 2½*d.* for Shropshire, 2¼*d.* for Suffolk, 2*d.* for Hampshire, 1¼*d.* for Dorset and Kent, and 1*d.* for Southdown. One great feature of the sales was the very high prices paid for lambs' wool, which in some cases realised more money than either ewe or hogg wool.

A comparison of the prices obtained at the sales with those current at Bradford indicates that buyers paid higher prices than the market warranted. This is said to be due to the presence at the sales in large numbers of the smaller cloth

manufacturers, who, of course, could afford to offer higher prices than the staplers, as they were able to save the middlemen's profit. The following table gives the details of numbers and prices at the leading sales:—

Sale.	Number of Fleeces.	Principal Breeds.	Average Price per lb.	
			Washed.	Un-washed.
			d.	d
Leicester ..	33,500	Lincoln Longwool	13	—
		Shropshire	15¼	—
Wellington (Salop)	75,000	,,	15⅝	13½
Colchester .	30,000	Suffolk Down .	14⅞	11⅜
Shrewsbury.	35,000	Shropshire ..	15⅜	—
Ipswich	42,500	Suffolk Down	14¾	11⅜
Nottingham	23,000	Crossbred . .	13¾	—
Oswestry ...	50,000	Crossbred Welsh	14⅜	—
Bury St. Edmunds	26,000	Suffolk Down	14	10¾
Cirencester .	20,000	Oxford Down	14½	11½
Lichfield	45,000	Shropshire . .	14½	12
Andover	33,500	Hampshire Down	14¾	11¾
Chichester .	45,500	Southdown	15	10⅝
Winchester .	70,000	Hampshire Down	15¼	11½
Salisbury	89,700	,, ,,	15⅞	11⅝
Blandford ..	81,200	,, and Dorset Down	16	11¾
Dorchester ..	107,700	Dorset Horned . .	16⅝	—
Devizes . . .	40,500	Hampshire Down	15⅝	10⅞
Marlborough .	60,000	,, ,, . .	15⅜	10⅝
Lewes . . .	50,000	Southdown .	15⅜	11⅝
Rye	20,000	Kent Longwool •	13⅝	—
Ashford . .	48,000	,, ,, ...	13⅛	—

SOME DOUGLAS FIR PLANTATIONS.

I.—TAYMOUNT PLANTATION, PERTHSHIRE.

FRANK SCOTT.

1. *General Description of Sylvicultural Conditions.*

The plantation is situated about a mile north-east of Stanley, and eight miles north of Perth. The area, 9·69 acres in all, is triangular in shape, and slopes gently to the south-east. Though situated in the Tay valley, it is far enough away from the river to be beyond the influence of rime, and late and early frosts are not of frequent occurrence. The annual rainfall is between 30 and 35 in. The elevation is from 235 to 255 ft.

The soil is red and loamy, and is about 9 in. in depth.

The subsoil is of stiff, tilly loam, and the underlying rocks are of Lower Old Red Sandstone. The plantation is sheltered on the south, south-west, west, and north-west by woods. Though older, these woods are now not nearly so high as the Douglas firs, and the latter are therefore much more exposed than formerly. The plantation now suffers more from gales on this account.

2. *History of Plantation.*

Formation.—Previous to 1860, when the area was planted, it was under regular cultivation. By the construction of the Highland Railway it was separated from the farm to which it belonged, and, as access to it was thus made difficult, it was planted up.

The planting was done in squares at the rate of 1,210 trees per acre, of which 303 were Douglas fir, and 907 were European larch. Every alternate row was of larch, while the other was of Douglas fir and larch alternately. The plants used were four years old, and the Douglas firs were grown on the Scone estate from seed of the original Douglas firs at Lynedoch, which were brought from British Columbia by Jas. Douglas.

Treatment.—The larches, which were doubtless meant to nurse the Douglas firs, were soon dominated by the latter. Gradually they became weakened, and in this condition fell an easy prey to canker. As the larches became suppressed or died from canker, they were removed, and by the twentieth year all had been cut out.

In 1887 a thinning was made in the then pure Douglas firs, from 600 to 700 stems being removed. It is generally admitted that this thinning was a great mistake. But for this opening-up of the crop at a time when the lower branches were only just beginning to die off, the crop would have been of much better quality now.

In 1888 the stems were pruned to a height of 15 to 20 ft., both living and dead branches being removed. In 1896 the pruning was continued to a height of 30 ft.

In 1897 the crop in the adjoining area on the north side was cut, and the wood became exposed, and during the winter a number of trees were blown down on that side.

In 1910 twenty-two dead trees were removed, and five more in the following year. In 1912 thirty-nine blown trees and thirty-three dead trees were cut out.

Yields from Thinning.—There is no record of what was received from the larch thinnings. The Douglas fir thinnings of 1887 realised £34, an average of 67 stems per acre being removed. The trees removed probably would not contain more than 2½ cub. ft. each, or 167 cub. ft. per acre, worth £3 10*s*.

In 1897 from 95 to 100 trees were blown down on the north side, or 10 stems per acre of the average volume of 25 cub. ft., or 250 cub. ft. at 6*d*. = £6 5*s*. per acre. Dead trees removed in 1910–11 were 3 per acre, sold at 2*s*. 3*d*. each, or 6*s*. 9*d*. per acre, the total volume per acre being 18 cub. ft.

Blown and dead trees removed in 1912 were 7 per acre, containing 145 cub. ft., and were sold with other blown timber, but were estimated to bring £3 12*s*. 6*d*. per acre. The following is an estimate of the yield from thinnings, &c., per acre:—

Total number of trees per acre = 1,210 {907 Larch, 303 Douglas Fir}

	£	s.	d.
Larch—Removed before 5th year and of no value, 30 per acre.			
Removed between 5th and 10th year, 100 at 1*d*. ...	0	8	4
" " 10th " 20th " 778 at 2*d*. .	6	9	8
	£6	18	0

Douglas Fir—

Year removed.	No. of stems per acre.	Volume per acre. Cub ft	Value per acre. £	s.	d.	£	s.	d.
1860–1887	42	—	—					
1887	67	167	3	10	0			
1887–1897	25	60	1	5	0			
1897	10	250	6	5	0			
1910–1911	3	18	0	6	9			
1912	7	145	3	12	6			
						£14	19	3
		Total Value of Thinnings, &c. =				£21	17	3

3. *Estimate of Volume of Timber.*

Method of Measurement.—The whole of the trees were first marked at 5 ft. from the ground with a short horizontal line, made by means of a scribe. The girth of each tree was then taken at 5 ft., the measurements being read to half inches. When all the girth measurements had been taken, the girths were divided into classes, the range of each class being

12 in. Class I. was from 1 ft. 3 in. to 2 ft.; Class II. from 2 ft. 0½ in. to 3 ft.; Class III. from 3 ft. 0½ in. to 4 ft., and so on. The girth of the average tree of each class was calculated by Weise's 40 per cent. rule. In Class III., for example, there are 340 trees (40 per cent. = 136). The 136th tree, counting from the stem of the greatest girth, falls within those of 3 ft. 9 in. in girth. The details of these measurements are set out in Table I.

The average trees were then carefully numbered and measured. As the trees vary a good deal in height, and taper, several, where possible, in each class and of the girth calculated, were taken in different parts of the wood, in order to obtain good average results. The height, which was taken by hypsometer, was measured to 12 in. in girth. The mean quarter girth was taken by actual measurement.

In the case of at least one tree of each class, measurements were made at every 10 ft. in height, and the volume worked out in sections. Leaving the trees in Class VII.* out of the calculation, the latter method gives an average increase in volume of 10·2 per cent. The figures obtained by these measurements are set out in Table II.

The bark deduction was found by barking a number of blown trees, the average thickness being found to be ½ in. in a tree of 9½ ins. mean quarter girth.

Table III. shows the estimated total volume of the plantation calculated from the data obtained as explained above.

From that table the following deductions may be drawn :—

	Quarter girth under bark.		Continental measurements.
	Ordinary method.	In 10 ft. sections.	
	cubic feet.	cubic feet.	cubic feet.
Total volume on 9·69 acres	58,570	64,530	81,950
Average volume per acre	6,040	6,660	8,460
Average annual increment per acre from time of formation of plantation	116	128	163
Average volume per tree	40·5	44·6	56·7

* This class contains few stems. It will be observed from the table that the volumes taken in section and by one girth show an abnormal difference.

TABLE I. GIRTHS OF TREES AT 5 FT. AND AT 4 FT. 3 IN. ABOVE GROUND.

CLASS I.			CLASS II			CLASS III.			CLASS IV.			CLASS V.			CLASS VI.			CLASSES VII AND VIII.		
Girth.	Number of Trees		Girth.	Number of Trees		Girth.	Number of trees.		Girth.	Number of trees		Girth.	Number of trees.		Girth	Number of trees.		Girth.	Number of trees.	
	At 5 ft.	At 4 ft. 3 in.		At 5 ft.	At 4 ft. 3 in.		At 5 ft.	At 4 ft. 3 in.		At 5 ft.	At 4 ft. 3 in.		At 5 ft.	At 4 ft. 3 in.		At 5 ft.	At 4 ft. 3 in.		At 5 ft.	At 4 ft. 3 in.
Ft. in.			Ft. in.			Ft. in.			Ft. in.			Ft. in.			Ft. in.			Ft. in.		
1 3	1	—	2 0½	1	2	3 0½	9	5	4 0½	13	21	5 0½	23	21	6 0½	5	6	7 0½	1	—
1 3½	—	—	2 1	5	1	3 1	5	7	4 1	27	21	5 1	24	18	6 1	8	8	7 1	—	2
1 4	1	—	2 1½	1	2	3 1½	10	8	4 1½	19	22	5 1½	18	18	6 1½	5	12	7 1½	1	1
1 4½	—	—	2 2	4	1	3 2	8	7	4 2	20	19	5 2	23	17	6 2	8	4	7 2	1	2
1 5	—	1	2 2½	4	6	3 2½	9	6	4 2½	18	16	5 2½	21	19	6 2½	6	6	7 2½	—	2
1 5½	1	—	2 3	5	6	3 3	14	10	4 3	14	19	5 3	18	24	6 3	6	7	7 3	1	—
1 6	—	2	2 3½	9	2	3 3½	7	10	4 3½	24	17	5 3½	23	23	6 3½	4	10	7 3½	—	—
1 6½	—	1	2 4	2	9	3 4	11	7	4 4	28	18	5 4	18	26	6 4	2	10*	7 4	—	—
1 7	2	—	2 4½	12	7	3 4½	12	11	4 4½	22	28	5 4½	13	18*	6 4½	4*	1	7 4½	—	—
1 7½	—	—	2 5	6	6	3 5	12	14	4 5	24	24	5 5	20	21	6 5	2	2	7 5	—	—
1 8	2	1	2 5½	3	8	3 5½	6	11	4 5½	18	24	5 5½	11	14	6 5½	2	2	7 5½	—	—
1 8½	5	1	2 6	8	4	3 6	19	12	4 6	15	20	5 6	23*	18	6 6	1	2	7 6	—	1

1 9	3	3	2 6½	7	1	3 6½	11	9	4 6½	29	22*	5 6½	15	20	6 6½	1	1	7 6½	—	1*
1 9½	1	3	2 7	6	7	3 7	15	13	4 7	27	25	5 7	18	18	6 7	3	2	7 7	—	—
1 10	1*	4*	2 7½	5*	10*	3 7½	10	15*	4 7½	21*	24	5 7½	6	10	6 7½	3	4	7 7½	—	—
1 10½	2	2	2 8	5	4	3 8	22*	16	4 8	16	24	5 8	11	16	6 8	4	5	7 8	—	—
1 11	2	1	2 8½	7	6	3 8½	22	14	4 8½	18	20	5 8½	14	20	6 8½	2	—	7 8½	—	—
1 11½	2	4	2 9	5	4	3 9	11*	20	4 9	15	17	5 9	6	10	6 9	1	4	7 9	—	—
2 0	4	1	2 9½	2	7	3 9½	20	16	4 9½	32	23	5 9½	12	14	6 9½	—	3	7 9½	—	—
			2 10	5	4	3 10	24	18	4 10	26	24	5 10	13	10	6 10	2	1	7 10	1	—
			2 10½	4	6	3 10½	19	15	4 10½	17	17	5 10½	2	6	6 10½	1	3	7 10½	—	—
			2 11	5	10	3 11	23	19	4 11	31	19	5 11	12	8	6 11	4	1	7 11	—	—
			2 11½	8	—	3 11½	15	9	4 11½	18	18	5 11½	5	6	6 11½	—	1	7 11½	—	—
			3 0	4	6	4 0	26	26	5 0	21	26	6 0	11	13	7 0	—	—	8 0	1*	—
																		8 0½	1	—
																		8 1	—	1
																		8 1½	—	1
																		8 2	—	—
																		8 2½	—	—
																		8 3	1	1
																		8 3½	—	1
Totals	27	24	—	123	119	—	340	298	—	513	508	—	360	388	—	74	95	—	8	13

* Average trees calculated by Weise's 40% rule

TABLE II.—AVERAGE TREES IN 10 FT. SECTIONS.

Class.	Tree No.	Total height.	Girths at *										Quarter girth volume, measured in 10 ft. sections		Quarter girth volume, ordinary methods of measurement.	
			5 ft	10 ft	20 ft.	30 ft	40 ft	50 ft.	60 ft	70 ft	80 ft.	90 ft.	Over bark.	Under bark.	Over bark.	Under bark.
			ft. in.	ft in	ft. in	ft. in.	ft. in.	ft in.	ft. in.	ft. in.	ft in.	ft. in	cub. ft	cub. ft.	cub. ft.	cub. ft.
I.	2	75	1 10½	1 8½	1 6	1 2½	1 0	—	—	—	—	—	5·7	4·9	5·6	4·4
II.	3	79	2 7½	2 3½	2 0	1 9½	1 6½	[48] 1 0	—	—	—	—	12 0	10·4	11·5	10·0
III.	1	81	3 9	3 3½	2 10½	2 7	2 4	1 10	1 5	[67] 1 0	—	—	28 2	24 8	26·1	22·8
	4	91	3 9	3 7	3 1½	2 9¼	2 5½	2 2	1 7½	1 2½	[73] 1 0	—	32 6	28·6	28·5	24·8
IV.	2	89	4 7½	4 4	3 11	3 7½	3 1½	2 9	2 2½	1 6	[78] 1 0	—	52 2	45·6	49·0	43 8
V.	4	101	5 6	5 0½	4 5½	4 2	3 7	3 1	2 7½	2 2½	1 3½	[82] 1 0	71·8	62 8	62·8	55·5
VI.	1	91	6 4½	5 8½	5 5	4 9½	4 4	4 0	3. 2	1 2	[72] 1 0	—	96·0	84·7	87·8	78·1
	3	98	6 4½	5 7½	5 2½	4 5½	3 11½	3 6	2 9	2 1½	1 0	—	89 4	79·5	80·0	70·3
VII.	1	94	8 0	7 2	6 2	5 5½	4 7½	3 8½	2 8½	1 10½	[78] 1 0	—	127·5	112·0	100·5	89 8
Largest tree	—	102	8 3	7 4½	6 0½	5 4½	4 11	4 0	2 11½	2 0½	1 11½	1 0	135·3	119·4	111·8	99·6

* The minimum girth tabulated is 12 in.; the height at which this minimum is reached is indicated by a figure in brackets (thus: [48]) in cases where such height is not the limit of a 10 ft. section

The total heights of the average stems are as follows:—

Class	I		II					III				
No.	1	2	1	2	3	4	5	1	2	3	4	5
Total height (ft)	63	75	72	76	79	63	71	81	82	99	91	84

Class	IV					V					VI				VII & VIII
No	1	2	3	4	5	1	2	3	4	5	1	2	3	4	—
Total height (ft.)	87	89	98	102	102	91	102	93	101	99	91	99	98	90	94

Annual growths of from 9 to 20 in. are still being made.

The form factors calculated from the average stems of each class for use with quarter girths at 5 ft. are:—

(1)	For volume calculated by Quarter Girth method* .	·32
(2)	,, ,, in 10 ft. sections	·35
(3)	,, ,, ,, ,, (Continental measurements)	45

* The following method was adopted to arrive at this form factor:—

Class I: $\frac{\text{Average volume (under bark)}}{\text{Average sectional area} \times \text{average height}} \times \text{No. of trees} =$

$$\frac{4\ 2}{(5\tfrac{1}{2}'')^2 \times 69} \times 27 = 7\ 82.$$

,, II ,, ,, ,, $= \frac{8\ 9}{(7\tfrac{7}{8}'')^2 \times 72} \times 123 = 35\ 30.$

,, III: ,, ,, ,, $= \frac{26}{(11\tfrac{1}{4}'')^2 \times 87} \times 340 = 115{\cdot}61.$

,, IV: ,, ,, ,, $= \frac{42\ 3}{(13\tfrac{7}{8}'')^2 \times 96} \times 513 = 169\ 07.$

,, V: ,, ,, ,, $= \frac{57{\cdot}3}{(16\tfrac{1}{2}'')^2 \times 97} \times 360 = 112{\cdot}48.$

,, VI: ,, ,, ,, $= \frac{74{\cdot}1}{(19\tfrac{1}{8}'')^2 \times 94} \times 74 = 22{\cdot}96.$

,, VII: ,, ,, ,, $= \frac{89{\cdot}8}{(24'')^2 \times 94} \times 8 = 1{\cdot}91.$

1445) 465 15

Form factor = ·32

TABLE III.—ESTIMATED TOTAL

Class.	No. of trees	Average stems. Serial Number.	Height to 12 in. girth.	Girth at half height.	Quarter girth at half height. Over bark.	Under bark.
			Feet	Inches.	Inches.	Inches.
I	27	1	36	17¼	4 5/16	4
		2	40	18	4½	4
II	123	1	49	23	5¾	5¼
		2	42	23	5¾	5¼
		3	48	23½	5⅞	5½
		4	53	21	5¼	4¾
		5	47	23	5¾	5¼
III	340	1	67	30	7½	7
		2	62	34	8½	8
		3	75	33½	8⅜	7⅞
		4	73	30	7½	7
		5	67	29½	7⅜	7
IV	513	1	64	38	9½	9
		2	78	38	9½	9
		3	75	38	9½	9
		4	78	39	9¾	9⅛
		5	77	39	9¾	9⅛
V	360	1	77	44½	11⅛	10⅜
		2	81	45½	11⅜	10⅝
		3	79	43½	10⅞	10⅛
		4	82	42	10½	9⅞
		5	82	41½	10⅜	9¾
VI	74	1	72	53	13¼	12½
		2	81	49½	12⅝	11⅝
		3	80	48	12	11¼
		4	82	48	12	11¼
VII	6	1	78	54½	13⅝	12⅞
VIII	2	1	—	—	—	—
Total...	1,445					

VOLUME OF THE PLANTATION.

Average Stems. Contents Ordinary quarter girth measurements. Over bark.	Average Stems. Contents Ordinary quarter girth measurements. Under bark.	Average volume under bark of individual trees in each class.	Volume of class. Quarter girth under bark. Ordinary method.	Volume of class. Quarter girth under bark. In 10 ft sections.	Volume of class. Continental measurements in 10 ft. sections.
Cubic feet.	Cubic feet.	Cubic feet.	Cubic feet.	Cubic feet	Cubic feet.
4·6 5·6	4·0 4·4	4·2	110	120	150
11·2 9·7 11·5 10·1 10·8	9·3 8·0 10·0 8·3 8·9	8·9	1,090	1,200	1,520
26·1 31·1 36·5 28·5 25·3	22·8 27·5 32·3 24·8 22·8	26·0	8,840	9,740	12,370
40·1 49·0 47·0 51·4 50·8	36·0 43·8 42·1 45·1 44·6	42·3	21,700	23,910	30,370
66·2 72·7 64·9 62·8 61·2	57·6 63·5 56·2 55·5 54·1	57·3	20,630	22,730	28,870
87·8 86·1 80·0 82·0	78·1 76·0 70·3 72·0	74·1	5,480	6,040	7,670
100·5 —	89·8 —	89·8	720	790	1,000
Total Volume			58,570	64,530	81,950

In order that comparisons may be made with Continental statistics, the whole of the trees were girthed at 4 ft. 3 in., as well as 5 ft. The figures obtained in each case will be found in Table I. The difference in sectional area at these heights is shown by the following table:—

Class.	Number of trees at		Average girth at		Average quarter girth at		Sectional area (in square feet) of classes at	
	5′	4′ 3″	5′	4′ 3″	5′	4′ 3″	5′	4′ 3″
I.	27	24	22″	22″	5·50″	5·50″	5 67	5·04
II.	123	119	31½″	31½″	7 87″	7·87″	52·89	51·18
III.	340	298	45″	45″	11·25″	11·25″	298 80	261·91
IV.	513	508	55½″	55½″	13·87″	13 87″	685·34	678·66
V.	360	388	66″	66″	16 50″	16·50″	680·62	733·56
VI.	74	95	76½″	76″	19 12″	19 00″	187·86	238·16
VII. & VIII.	8	13	96″	90½″	24·00″	22 62″	32 00	46·19

		At 5 ft. Square feet.	At 4 ft 3 in. Square feet.
Total sectional area of crop . ..		1,943	2,014
Average ,, ,, ,,	per acre	200	208
,, ,, ,, ,,	per tree	1·34	1 39

The approximate form factors for use with measurements at 4 ft. 3 in. are:—

(1)	For volume calculated by Quarter Girth method . .	·33
(2)	,, ,, in 10 ft sections	·36
(3)	,, ,, ,, ,, (Continental measurements)	·46

4. *Comparisons of Volume Measurements made in the Past.*

In the subjoined table (p. 413), measurements, taken at various stages since 1888, are given.

In order that comparisons may be made of the volume estimated to be produced between certain dates, the thinnings and windfalls have been added. The method of measurement was different in nearly every case, and it is not surprising, therefore, that the results do not compare very closely.

Comparing the volume as measured in 1910 in almost the same way as that taken in October, 1912, an increase of 271 cub. ft. per acre per annum is the result.

This is believed to be in excess of the actual current annual increment, the reason being that the sample stems in Classes IV. and V. of the 1910 measurements have been found to be

somewhat below the average, trees of less than average height having been selected. From measurements of increment taken from blown trees, it is estimated that the current increment is rather below than above 250 cubic ft. per acre per annum.

As the average stems of each class have now been carefully marked and numbered, it will be possible within a year or two to give more reliable figures regarding the current rate of increment.

Date.	Volume qr. gth.	Vol. in 10 ft. sections.	Vol. Cont. measurements	Thinnings to date, qr. gth.	Total vol. qr gth produced to date.	Average annual increment to date	Average annual increment from date to 1912.
	cub ft	cub ft.	cub. ft	cub ft	cub. ft	cub ft.	cub ft.
1888	2,690	2,943	3,738	167	2,857	102	159
1900	3,489	3,818	4,850	477	3,966	99	226
1904	3,598	3,937	5,000	477	4,075	92	326
1908	5,310	5,809	7,377	477	5,787	120	224
1910	5,646	6,176	7,843	495	6,141	122	271
1912	6,044	6,612	8,397	640	6,684	128	—

The above measurements were made as follows:—

1888 by Dr Schlich 1900 by Dr Nisbet 1904 by Mr Elwes
1908 by Mr. Kinnear 1910 by Mr Scott 1912 by Mr. Scott

5. *Quality of the Timber.*

Among home timbers, that of the Douglas fir will rank in value between Scots pine and larch. It is more durable than Scots pine, and may be equal to larch in this respect. The tree has a much stronger branch development than either of the above species, and larger knots are therefore formed in its timber. On this account it is not so strong as either larch or Scots pine.

The heartwood is developed early, and in trees 52 years old it may be found to form 70 per cent. of the whole.

In a converted state—as $\frac{7}{8}$ in. boarding—it is lighter than spruce. The following are the weights of 1,000 sq. ft. of boarding of Scots pine, spruce, and Douglas fir. All had been stacked for about the same period:—

		Cwt.
Scots Pine (100–130 years old)	=	29·8
Spruce (90–100 „)	=	26·3
Douglas Fir (40–50 „)	=	24·6

ESTIMATE OF RENT

	£ s d.	Total Cost.	No of years at 3% Com. Int.	Present Value.
EXPENDITURE.				
Cost of Formation—		£		£
Planting—303 Douglas firs 4 yrs. home raised at 40*s*. per 1,000	0 12 0	—	—	—
907 Larch .. .	1 10 0	—	—	—
Planting 1,210 Plants... ..	0 16 0	—	—	—
	2 18 0	2 9	—	—
Draining—About per acre . .	0 13 4	0 66	—	—
Fencing—580 yards Net Fence at 7½*d*.	18 2 6	—	—	—
390 ,, Netting only at 5*d*.	8 2 6	—	—	—
9·69 acres	26 5 0			
1 acre	2 14 2	2·71	—	—
		6 27	52	29·16
Cleaning, etc.—				
Cleaning, cutting out dead Larch, care of drains and fences for first five years at 5*s*. per acre		0 25	47	1·00
Thinnings—				
Cutting out of 100 dead Larch, between five and ten years at 3*s*. per acre. .		0 15	42	0·52
Cutting out 778 dead Larch at 6*s*. per 100 up to twenty years : per acre . .		2·33	32	6·00
1887 Thinning out of 650 Douglas Fir or sixty-seven per acre at 12*s*. per acre . . .		0·6	25	1·26
1888 Pruning trees 15 ft. to 20 ft. at 15*s*. per acre		0·75	24	1 52
1896 Pruning trees 308 at £3 4*s*. per acre		3·2	16	5 13
1897 "Snedding," etc., 250 ft. blown timber and burning up at 4*s*. per 100 ft. : per acre . .		0·5	15	0 78
1910, 1911 Removal of 22 dead trees and burning up, £2 2*s*. in all : per acre		0·21	1	0·22
1912 Removal of blown trees and burning up of branches, £9 3*s*. 4*d*. in all : per acre		0·94	—	0·94
Total Net Outlay		...	.	46 53
Net Profit		.	.	182·56
				£229·09

A profit of £182·56 at the end of fifty-two years is equivalent, at 3%, to a rent out at £1 4*s*.

OBTAINABLE PER ACRE.

		Total Value.	No. of years at 3% Com. Int.	Present Value.
INCOME.				
Thinnings—		£		£
Fifth to tenth year		0·41	42	1·42
Tenth to twentieth year		6·48	32	16 69
1887		3·5	25	7·33
	£			
Dead trees to 1897	1·25	—	—	—
Blown trees, 1897 = ten containing 250 ft. ...	6·25	—	—	—
	7·5	7·5	15	11·68
Dead trees, 1910–11		0·33	1	0·34
Blown timber, 1912 = seven trees containing 145 ft. at 6*d*.		3·63	—	3·63
Present value of growing stock . ..		188·00	—	188·00
Total Gross Income...				£229·09

of £1·5 or £1 10*s*. per acre paid annually. On a 3½% basis, the rent works

The difference would not be so great in older and more slowly grown Douglas fir.

In a dressed state its wood has been used on the Scone estate for gates, a panelled door and linings for indoor finishings. In an undressed state it has been used for fencing posts, and a quantity of battens have been prepared from it. It has been sold from the estate sawmill as packing-case boarding, hutch boards for collieries, and for railway and pit sleepers.

Value of Plantation, October, 1912.

	s	d
Converted into boards, Douglas fir is worth, free on rail, Perth, per foot	1	3
Carriage from Stanley to Perth		¼
Value per foot at Stanley Station	1	2¾
Cartage from plantation to Stanley Station ..		½
	1	2¼
Felling, dragging to mill and conversion, per foot		2¼
	1	0
25% loss in conversion		3
Net value of timber standing		9 per foot.

Take 70% of crop at 9*d*. = 6·30*d*
and 30% of crop as sleepers and pitwood at 4*d* = 1·20*d*

7·50 = 7½*d* average price per foot.

Total value of plantation = 58,570 feet at 7½*d* = £1,830 or £188 per acre

Rhizoctonia Diseases.*

A DISEASE due to the fungus *Rhizoctonia violacea,* Tul., was recognised and described nearly two hundred years ago as the cause of serious injury to the saffron industry in France. It was at that time also noted that the disease attacked the roots of many other kinds of plants, both wild and cultivated. From this period it has not only continued its ravages, but has attacked in turn almost every new plant introduced to cultivation. It does not, however, attack cereals.

Plants Attacked.—In this country *Rhizoctonia* has a special predilection for lucerne; clover, parsnips, carrots, beet, mangolds, sea-kale and potatoes sometimes also suffer severely, and most frequently when they follow lucerne, which appears to attract the stray mycelium of the fungus present in the

* This is the Board's Leaflet No 171 as now re-written.

soil. The mycelium increases enormously in quantity on the root of this plant, and a large stock remains in the soil in a vigorous condition ready to attack any suitable host. If the following crop happens to be a cereal, which the fungus cannot feed upon, it attacks weeds of various kinds, and thus tides over the period until a crop suitable to its requirements is planted, when a fresh stock of mycelium is again left in the soil.

Description and Appearance of Plants Infested.—The disease is readily recognised by the bright colour of the mycelium of the fungus, which varies from rose, with a tinge of purple, to a deep brownish purple when old. The mycelium at first spreads as a delicate, much-branched network over the surface of the root or tuber, and finally forms dense patches, or covers the entire surface with a compact felt (see Fig. 1). As a rule the fungus confines its attacks to underground parts of the plant, but when the weather is continuously damp and dull the mycelium sometimes extends up the stem, and even passes on to the leaves and fruit.

The first sign of disease is the drooping and yellowing of the foliage; the presence of violet mycelium on the surface of a carefully removed root proves the fact.

Sources of Infection.—So far as is at present known, the fungus does not form fruit, its only mode of reproduction being vegetative by means of mycelium.

The way in which the fungus spreads in the soil and keeps its hold can readily be seen. When a root or tuber has become superficially coated with a felt of mycelium, sclerotia or concentrated masses of mycelium of two distinct kinds of structure, and having different uses, are formed. Some sclerotia are of considerable size, varying from that of a pea to a hazel-nut; these become free from the root when fully formed, and remain in the soil as centres of future infection. Other sclerotia, rarely exceeding the size of an ordinary pin's head, are usually produced in considerable numbers under the felt of mycelium, and in close contact with the root or tuber, to which they remain firmly attached, and are removed along with it. If such infected roots or tubers are eaten by some animal, the minute, compact sclerotia are not injured by passing through the digestive system, and

are in this way often transported to new localities. In like manner new districts are often infected by means of minute sclerotia attached to potato tubers, carrots, &c. In some instances beans and peas are attacked while yet in the pod, and minute sclerotia are formed in the skin of the seed.

The disease usually spreads from a point of infection equally on every side, the mycelium gradually spreading through the soil from diseased to healthy plants.

Injury Caused by the Disease.—The amount of injury caused by the fungus varies to a great extent on different plants. In the case of *beet* and *carrots,* the mycelium soon enters the fleshy root and destroys it. In *lucerne* and *clover* the active rootlets are killed. In *potatoes,* mycelial strands originating from the small sclerotia described above penetrate the skin and ramify abundantly in the internal tissues, causing a rot which soon reduces the tuber to a pulp.

Preventive and Remedial Measures.—1. Good drainage and the prevention of sourness of the soil are essential features in combating the disease. Liming is of value in preventing acidity of the soil.

2. Weeds should be rigorously suppressed, for they furnish the main supply of food for the fungus, when a cereal crop is present.

3. Care must be taken not to introduce the disease by means of small sclerotia adhering to seeds or tubers.

4. Seed obtained from dry, high-lying districts should be selected.

5. Diseased plants should be removed and burned, and the soil treated with a disinfectant before being re-planted. In the case of sea-kale, the best results have been obtained by treating the soil some days before planting with a solution of carbolic acid (1 oz. to a gallon of water). The sea-kale not only came up free from disease, but actually appeared to be stimulated in growth.

Good results have also been obtained by the use of corrosive sublimate solution (1 oz. to every 8 gallons of water).

6. Before planting, seed potatoes should be steeped for two hours in a solution consisting of one pint of commercial formalin (=40 per cent. formaldehyde) in thirty-six gallons of water.

RHIZOCTONIA DISEASES.

1 *Rhizoctonia violacea*.—The illustration shows the brownish-purple mycelium, which occurs in patches and radiating strands over the surface of the tubers. Mycelium also enters the flesh, and destroys the tissues.

2 *Rhizoctonia Solani*.—The sclerotia, which in this species are entirely superficial and apparently cause little or no injury, are seen as conspicuous blackish bodies. They can be scraped off the tuber without difficulty.

3 Later stage of *R. Solani*.

Potatoes are also attacked by another species of *Rhizoctonia*, *R. solani*, Kühn. The tubers are found covered with small black bodies, or sclerotia, of irregular shape, connected only by fine threads of mycelium which are not visible to the naked eye (see Figs. 2 and 3). These bodies can be easily scraped off, leaving very little scar, and do not appear to cause much injury beyond rendering the tubers unsightly. In America, however, it seems that the fungus may cause serious losses by attacking the young sprouts.

R. solani has been stated to be the underground, sterile state of the Potato Collar-fungus.

Hypochnus solani, Prill. et Del.—The latter forms a very thin, greyish, or fawn-coloured film round the base of living potato haulms, but the mycelium is entirely superficial, and does not appear in this country to cause any injury.

The treatment recommended for *R. violacea* is applicable also to this disease.

Progress of Afforestation on Inverliever Estate, Argyllshire.*

THE Board have been furnished by the Commissioners of His Majesty's Woods and Forests with the following account of the progress of the work on the Inverliever Estate during 1912:—

Attention to New Plantations.—During the summer the young plants were kept clear of weeds. In compartment I. 29,900 plants, chiefly common spruce and Sitka spruce, were used for replacing failures, including 11,000 spruce on a small area accidentally burned. In compartment II. 4,300 plants, in compartment III. 6,500 plants, and in compartment IV. 20,100 plants were also put out to replace failures.

The young trees on the slopes of the ground first planted are growing very well. The spruce on the higher and wetter ground is for the most part not yet fairly established.

New Plantations formed during 1912-13.—In compartment IV. 55 acres were planted with 123,400 trees, including 103,600 common and Sitka spruce, while in compartment V. 123 acres

* Previous reports on the Inverliever Estate have appeared in this *Journal* Vol. XV, p. 620; Vol. XVI, pp. 219, 980; Vol. XVII, p. 308; Vol. XVIII, p. 321, and Vol. XIX, p. 305.

were planted with 261,700 trees, including 111,100 common and 7,800 Sitka spruce. The land in compartments IV. and V. faces from S. to S.W. and is somewhat exposed. For this reason, or because of the peaty nature of the soil, 23 acres were left unplanted in compartment IV. and 15 acres in compartment V.

In all 1,792 chains of ordinary drains were cut in the wet ground and 802 chains of special drains cut for the upturned-turf system of planting.

The Nursery.—Considerable progress was made during the year towards getting the nursery into full working order. Of the total of 445,900 young trees used in planting operations 422,800 were obtained from the nursery and 23,100 were purchased; 317,500 seedlings were also lined out from the nursery seed-beds and 104,000 seedlings were purchased for the same purpose. The seed sown in the nursery included 73½ lb. of various coniferous seed and 50 lb. of beech. Some of the nursery stock has suffered from frost and from cold winds.

Damage from Game.—The game question has, as formerly, been somewhat troublesome. It has been found very difficult to exterminate rabbits owing to cairns within the enclosures, and during heavy snowstorms in January and February hares were able to pass the enclosure netting.

Black game were less troublesome on newly-planted ground, owing, no doubt, to the fact that no Scotch pines were planted. The birds have, however, been particularly severe on the older larch.

General.—Buildings consisting of a foreman's cottage, a handyman's cottage, and a bothy for the nursery staff, have been completed and are occupied.

A cottage at Kilmaha with grazing and arable land attached was in course of completion at the end of the financial year.

By an arrangement with the local authorities the public road in Lorn district was maintained in order, and the section in Mid-Argyll district placed in a better state of repair.

A good deal of delay was experienced in planting operations owing to continuous bad weather.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

The Woburn Pot Experiments, 1910-11-12.—The report on the above experiments by Dr. Voelcker deals with (1) the influence of the salts of lithium, zinc, and lead on wheat, and (2) the relation of lime to magnesia in soils. From the experiments with lithium, zinc, and lead it is concluded that lithium in the form of any of its salts produces a toxic effect if it is present in the soil to the extent of 0.003 per cent., or above that amount. The greater the amount of lithium present the greater is the toxic effect. When present in the soil to an amount not exceeding 0·002 per cent., lithium has a stimulating influence. Though this applies to all salts of lithium the nitrate seems to be the most stimulating one, producing the best results when present not in excess of 0·001 per cent. of lithium.

Zinc salts, especially the nitrate, if present in the soil to an amount supplying less than 0·02 per cent. of zinc, have a stimulating effect; larger amounts were found to have a toxic effect. Zinc exercises only one-tenth the toxic or stimulating influence that lithium does. Lead, when present to the extent of 0·03 per cent., does not possess any toxic influence upon vegetation, and when this amount is given in the form of the nitrate a stimulating effect is observed. With regard to the influence of lime and magnesia on wheat, it is concluded that this plant may benefit from the addition of magnesia to a soil poor in that material, so long as the amount of magnesia does not exceed that of lime. If magnesia is present in excess a toxic influence will be exercised and the crop diminished. Soils containing an excess of magnesia will benefit from the addition of lime. Magnesia and lime are capable of modifying the growth of the wheat plant; the leaf is stronger and greener, the root growth is much developed, and very fibrous, and a glutinous grain is produced because of the greater assimilation of nitrogen.

Green Manuring (*Rept. on the Woburn Field Expts.*, 1912).—(*a*) Two acres on which mustard, rape and tares were grown and fed on the land to sheep in 1911 were ploughed, limed, and sown with Square Head's Master wheat. A dressing of 4 cwt. of superphosphate and 1 cwt. of sulphate of potash was given. The following table gives the produce per acre :—

	Head Corn.	Straw, &c.		
	Bushels.	cwt	qr.	lb.
After Tares .	18·8	12	3	25
,, Rape	20·9	14	2	7
,, Mustard .	18·2	12	2	11

* A Summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

(*b*) Tares, rape, and mustard were grown in 1911 and ploughed in. Wheat was grown in 1912, and the effect of mineral manures was compared with that of lime in the case of each green crop.

The average of the two "tares" plots was 10·2 bush., of the "rape" plots 13 bush., and of the "mustard" plots 16·8 bush. of corn per acre. The limed plots did not, as in 1910, exceed the mineral manured ones.

In experiment (*b*) it will be seen that the greatest yield was obtained after mustard, whereas in (*a*) the "rape" land produced the largest crop.

The Percentage of Total Phosphorus in Purple-top Turnips as Influenced by the Amount Available in Soils (*Bull.* 154, *Agric. Expt. Sta., Rhode Island State Coll.*).—A field experiment was begun in 1894 to ascertain the availability of the phosphorus in different phosphatic manures when applied to limed and unlimed soil. It was found that direct estimation of soil phosphorus was unsatisfactory, and in order to find the relative amounts of available phosphorus present in the various plots the crops themselves were analysed. Of the different crops grown it was observed that the turnip was the only one in which the percentage of phosphorus appeared to be influenced markedly by the amount available in the soil as shown by the yield of the crops. It is suggested that probably, under similar climatic conditions, the relative amount of available phosphorus in different soils may be indicated by the relation between the percentages of phosphorus in turnips grown on those soils The percentages of phosphorus pentoxide in dry matter varied from 0 27 in turnip roots grown on soils extremely deficient in phosphorus to 1 82 in those from a soil having an abundant supply. Maximum growth was usually obtained when about 1 per cent. of phosphorus was present. Turnips of the same age grown on a certain soil contained about an equal percentage of phosphorus. In no case did liming or the increase of the amount of water supplied decrease the percentage of phosphorus. Applications of muriate of potash appeared to increase the percentage of phosphorus.

FIELD CROPS.

Varieties of Rye-grass (*Rept on the Woburn Field Expts.*, 1912).—On May 12th, 1911, three small plots were sown with different varieties of rye-grass, viz., Italian rye-grass, Pacey's rye-grass, and a new Dutch variety. Owing to the very dry season there was practically no crop to cut the first year, and the plots were carried on to 1912. The Dutch variety was observed to be distinctly earlier than the others. In 1912 the plots were cut for hay, the first crop on June 14th, and the second on October 4th. The following table gives the produce of hay per acre :—

Variety.	First Crop.				Second Crop			Total.			
	tons	cwt.	qr.	lb.	cwt.	qr	lb.	tons	cwt.	qr.	lb.
Pacey's Rye-grass	1	0	1	27	6	1	20	1	6	3	19
Dutch ,, ...	1	3	1	6	12	1	23	1	15	3	1
Italian ,, ...	1	18	3	25	12	3	12	2	11	3	9

Inoculation of Soil for Lucerne (*Journ. of Agric., New Zealand, May,* 1913; *Primrose McConnell, Ruakura Farm*).—In November, 1912, lucerne was sown on three plots—(*a*) non-inoculated; (*b*) inoculated with one-year-old soil; and (*c*) inoculated with soil in which lucerne had been growing for three years. For some time all three plots were very similar in appearance, but on April 6th, 1913, while the non-inoculated plot had a decided yellow colour, the other two plots looked exceedingly healthy. The one-year-old soil gave as satisfactory results as the three-year-old soil.

Inoculation of Leguminous Crops (*Rept. on the Woburn Field Expts.,* 1912).—An experiment was carried out in order to ascertain if a new method which has recently been adopted in the preparation of cultures for inoculation purposes got over difficulties experienced in the past. Cultures from the nodules of leguminous plants were formerly kept in air-tight receptacles or absorbed in cotton-wool, earth, &c , whereas in this new method air is allowed entrance after being filtered through cotton-wool.

Six small plots were set out, and on May 25th two were sown with lucerne, two with red clover, and two with white clover. In one case the seed was sown direct; in the other the seed was first soaked in the culture preparation, and was then air-dried and sown. The crops were cut and weighed on October 4th, and in each case the crop was slightly increased as the result of inoculating the seed before sowing it.

Varieties of Lucerne (*Mitt. Deut. Landw. Gesell., June 7th,* 1913).—Experiments with lucerne seed from various sources were carried out from 1900–12 at the Danish Experiment Stations at Tystofte, Lyngby, and Askov. The origin of the seed and the relative yields in terms of the yield from Hungarian seed were as follows:—

Origin	First year crop	Second year crop	Third year crop
Hungarian	100	100	100
German ..	102	92	89
French	102	96	97
Italian .	104	96	90
Russian ...	94	83	69
American	45	49	67

Hungarian seed showed great permanence, and was found to be the best for Danish conditions. The first cutting of every year yielded a good crop, but the aftergrowth was not as good. It will be noticed that the first year's yield from some of the other varieties was greater than from Hungarian seed.

At Lyngby in 1910–11 the effect of cutting the lucerne in the year of seeding was tested. It was found that the first year's crop, together with the yield in the year of seeding, were not equal to the first year's crop where the lucerne had been left untouched in the year of seeding.

Varieties of Lucerne (*Rept. on the Woburn Field Expts.,* 1912).—Seven varieties of lucerne were sown in 1911, one-half of each in a barley crop, the other half without a covering crop. The plots sown

without a covering crop looked, after harvest, distinctly better than those put in with barley, though they were not so clean. The plots were hoed January 3rd–17th, 1912, and on April 10th a dressing of 4 cwt. of superphosphate and 5 cwt. of rape dust was given per acre. The lucerne was cut on August 7th, and made into hay, which was weighed on August 15th–16th. The following table gives the produce of hay per acre :—

Variety.	Sown under a corn crop		Sown bare	
	cwt.	qr.	cwt.	qr.
Russian (Europe)	24	2	37	2
Canadian ...	9	2	20	2
Provence	9	2	19	0
North American ...	9	2	17	2
Russian (Asia)	9	0	16	2
American (Arizona)	8	2	15	2
Turkestan	6	0	11	0

It will be seen from the above table that (1) the produce all round was nearly doubled by sowing the lucerne "bare"; (2) the Russian (Europe) variety gave the largest crop.

LIVE STOCK AND FEEDING STUFFS.

Balanced v. Unbalanced Rations for Dairy Cows (*Univ. of Illinois Agric. Expt. Sta., Bull. No.* 159).—With a view to demonstrate the loss which may be sustained by dairymen who supply their cows with unbalanced rations, the Department of Dairy Husbandry carried out the following experiment. Two lots of 9 cows producing practically equal quantities of milk and butter fat were treated for 131 days in every way alike, except in the rations fed. The treatment for several months previous to the commencement of the experimental period had been the same for all the cows. The rations supplied were as follows :—

	Lot. 1	Lot 2.
Maize Silage	30 lb	30 lb.
Clover Hay	8 ,,	5 ,,
Gluten Feed		3
Ground Maize	3¼ ,,	8

The ration fed to Lot 1 was a well-balanced one for cows giving 40 lb. of milk daily, and had a nutritive ratio of 1 : 6, while that fed to Lot 2 was deficient in protein, and had a nutritive ratio of 1 : 11.

The following conclusions were reached :—

The quality of the ration affects the physical condition of the animal, and the physical condition vitally affects consumption and production. The cows on the unbalanced ration lost greatly in flesh during the test, and their subsequent production was reduced. Lot 1,

which received the balanced ration, produced approximately one-third more than Lot 2, receiving the unbalanced ration. Thirteen cows on a ration with a nutritive ratio of 1 : 6 produced as much as eighteen cows on a ration with a nutritive ratio of 1 : 11. Because of the lack of protein in the ration fed to Lot 2 the other nutrients were not used to the best advantage. This shows in a striking manner that an excess of carbohydrates cannot be made to take the place of a deficiency of protein.

Effect of Change of Pasture and Feed on Milk Production (*Journ. of Agric., New Zealand, May,* 1913; *Primrose McConnell, Ruakura Farm*).—The dairy herd on the Ruakura Farm received, in addition to pasture grass, a liberal supply of forage in the form of chou moellier, millet, peas, and maize, from the new year until March 27th. It was then found that the milk yield had commenced to decrease very rapidly. The cows which were nearing the end of their lactation period were taken from the pasture field and confined in a field of green barley and tares. As will be seen from the following table, both yield of milk and butter-fat content were considerably increased :—

Name of Cow	Milk yield for week previous to removal to Tares and Barley	Percentage of Butter Fat.	Milk yield for second week, on Tares and Barley	Percentage of Butter Fat.
Jerseys—	lb		lb.	
Little Fancy	94·7	5 0	109 6	5 4
Wild Briar	100·9	5·9	120 1	6 4
Cherry Blossom	93·5	5 6	119 7	5 6
May Flower	100 9	5 0	135 5	6 0
Dominion Hope	85 7	5·2	113 5	5 6
Shorthorns—				
Adelaide	186·8	3 2	249·2	4·6
Daisy	100 6	3 8	141 3	4 6
Jean ...	100 2	4·3	158·7	4 6
Miss Cox	99 1	4·2	141 8	4·4
Bean	218 0	3 2	282 6	3 4

It is stated that the weather was cooler during the period when the cows were on the barley and tares than it had been previously, and that this was a factor which influenced the yield of milk and fat to some extent.

POULTRY.

The Care of the Farm Egg (*U.S. Dept. of Agric., Bureau of Animal Industry, Bull.* 160; *H. M. Lamon and C. L. Opperman*).—With the view of determining the causes of the enormous loss in eggs, and, if possible, working out methods for its elimination, extensive experiments were carried out in the State of Kansas. The following are the chief conclusions reached. An unheated room in a dwelling house is not conducive to good quality in eggs. The production of spots, blood rings, and rots is favoured by the conditions obtaining during the hot summer months. The greatest deterioration in fertile eggs occurred

in the experiments which included a certain amount of natural incubation. Both fertile and infertile eggs taken from straw-stack nests gave the greatest number of spots; this was the only case in which a large number of infertile eggs deteriorated to such an extent as to be unfit for food. Infertile eggs, regardless of where they may be kept, are more resistant to deterioration than fertile ones. The haphazard methods of poultry management on farms are responsible for two-thirds of the total loss in fertile and infertile eggs. The production of the infertile egg seems to be the greatest asset in the attempt to produce high quality market eggs during hot weather. Eggs of high quality would be produced and much loss prevented if egg producers would observe the following rules:—

(*a*) Give the hens clean nests.
(*b*) Gather eggs at least once daily.
(*c*) Keep eggs in a cool dry place.
(*d*) Market eggs at least twice a week.
(*e*) Kill or sell all mature male birds as soon as the hatching season closes.

The Utility Poultry Club's Twelve Months' Laying Competition.—The report for the ninth period of four weeks states that the warm, dry weather of June resulted in broodiness claiming a large number of the birds. The results for the nine months show very even laying on the part of the birds; here and there when a pen started late it has risen a great many places, but on the whole, particularly among the leading pens, there has been little variation. During the ninth period there was no alteration in the placing of the first five pens, but Pen 60, White Wyandottes, improved the lead which they gained in the preceding period on Pen 86, Buff Rocks The scores of the leading pens to the end of the ninth period were as follows --

Order.	Pen No	Breed	Total Eggs for Nine Months.	Total Money Value		
				£	s.	d
1	60	White Wyandottes	941	4	13	10
2	86	Buff Rocks	871	4	12	3½
3	32	White Wyandottes	890	4	5	11½
4	45	,, ,, ..	819	3	19	11½
5	35	,, ,,	814	3	17	8
6	80	Buff Orpingtons	787	3	17	0¾
7	54	White Wyandottes	829	3	16	10
8	24	Black Leghorns ...	769	3	16	4

South Australian Egg-laying Competitions, 1912-13 (*Rept of Dept. of Agric., South Australia, on the South Australian Egg-Laying Competitions,* 1912–13).—This report gives a full account of the Laying Competitions at Roseworthy and Kybybolite Poultry Stations, which terminated on March 31st, 1913. The first few pages are devoted to estimating the practical value of such competitions, and it is claimed that they demonstrate "the value of good breeding" in producing "a robust class of fowl, true to certain type, and with the character of high egg production strongly developed." Among the "undesirable

features" which the competitions have revealed in the stock are the prevalence of broodiness in Leghorns and a somewhat marked weakness in the organs of reproduction in certain pens.

In the *Roseworthy Competition,* which was the ninth test of the kind held in the State, the entries were divided into three sections. The first was confined to birds of the Mediterranean breeds, and contained 83 pens of white Leghorns. Thirty-one pens were entered in Section 2, open to the heavy breeds; of these 22 were Black Orpingtons, 6 were Silver Wyandottes, while one pen of Salmon Faverolles, one of Langshans, and one of Plymouth Rocks were included. Section 3, described as the "Scratching Shed" Section, contained 20 pens of White Leghorns, and the birds in this section were kept entirely in the house from April to September. The result of the test as a whole is set out below:—

No. of Hens	Eggs laid	Average per hen	Eggs laid by winning pen	Market value of eggs. £ s d
804	146,329	182	1,413	663 11 2

Cost of Food per hen s d	Return per hen s d	Profit per hen s d	Average price of eggs s d	
5 7 8	16 6	10 10 2	1 1 06	per dozen

In the third section, the twenty pens confined to scratching sheds produced 23,354 eggs, and the twenty "open yard" pens of similar breeding produced 23,723 eggs.

At *Kybybolite,* Section 1 consisted of 26 pens of White Leghorns and one pen of Minorcas; in Section 2 there were three pens of Black Orpingtons, two pens of Silver Wyandottes, and two pens of Plymouth Rocks.

The summary of results is set out below:—

No of Hens.	Eggs laid.	Average per hen	Eggs laid by winning pen	Market value of eggs £ s d
204	36,675	179 8	1,530	166 6 2 57

Cost of Food per hen. s d	Return per hen s. d	Profit per hen s. d	Average price of eggs s. d
5 8	16 3 5	10 7 5	1 1·06 per dozen

In both competitions any pens from which the eggs did not attain an average weight of 24 oz. per dozen by July 31st, 1912, were deprived of participation in the prize money.

In future the laying competitions will be held at one centre, viz., at Parafield Poultry Station, where the 1913–14 competition is now in progress, the total number of birds entered being 960.

DAIRYING.

The Advisability of Adding Water to Milk in the Manufacture of Clotted Cream (*Board of Agriculture and Fisheries, Ann. Rept., Intell.*

Div., Part I., 1912).—In some districts in the west of England it seems to be a practice, in the manufacture of clotted cream, to add water to the milk before scalding, and apparently excellent cream is produced in Devon and Cornwall both with and without the use of water. Mr. Wilfrid Sadler, of the Midland Agricultural and Dairy College, was deputed by the College to investigate the desirability of this practice, and experiments were carried out with apparatus similar to that in use in the west of England. Two pans of milk were scalded simultaneously, one containing milk alone, while water was added to the milk in the second pan, the water being poured in first. After remaining for from 12 to 15 hours to allow of the rising of the cream, the scalding process was carried out. The temperature of the water for scalding was at first 195° F. to 2050° F., but in later experiments it was raised to 205° F. The scalding was at first allowed to take from 15 to 20 minutes, and the resulting temperature of the milk and cream on removal from the heating apparatus was from 180° to 185° F., but later, the scalding occupied from 25 to 30 minutes, when the temperature of the milk and cream was 187° F. The finest samples of cream were secured by the latter method.

After the scalding was completed, the pans were taken off and allowed to remain for 24 hours, when the clotted cream was skimmed. Samples of the cream were analysed, while others were sent to various authorities on Devonshire cream in order that the flavour, texture, and general marketable quality might be judged.

The results of the experiments showed that—

1. A clotted cream of superior quality as regards flavour and texture can be produced from normal milk, rather than from milk to which a variable or fixed quantity of water has been added.

2. The addition of water does not appreciably add to the actual weight of cream produced and does not appear to affect the percentage of fat in the cream.

3. The use of water in the bottom of the creaming pan has no influence whatever on the amount, or as far as can be seen, the nature of the sediment which remains in the pan after the taking away of the scalded milk.

4. The clotted cream produced from milk to which water has been added does not possess the keeping qualities of similar cream raised from normal milk.

5. While depreciating both the food and the commercial value of "scald milk," no corresponding advantage can be shown to result from the use of water either with regard to the "scald milk" or the Devonshire clotted cream. In fact, as regards the latter, experiments tend to prove that there are sufficient disadvantages to warrant a discontinuance of the practice.

NOTES ON CO-OPERATION AND SMALL HOLDINGS.

Scarborough and District Co-operative Credit Bank.

This Town Credit Society, which is affiliated with the Urban Co-operative Banks Association, was founded in 1909 and registered under the Industrial and Provident Societies Act, its object being to carry on the business of banking on co-operative principles for the benefit of its members. Membership is confined to persons resident in or connected with Scarborough and the surrounding district. Each member must be approved by the Committee, and is required to pay an entrance fee of 6*d*., and to take at least one share in the Society of the amount of £1, to be paid in full or in instalments of at least 6*d*. per week, and his liability for the debts of the Society is limited to the amount of the shares for which he has subscribed. The Society grants loans to its members usually for a period not longer than 40 weeks, with interest which for the present is fixed at 2*d*. per £1 per month, that is, 10 per cent. per annum. Loans are made in sums of 5*s*. and upwards, for both business and domestic purposes, and must, except under special arrangement, be repaid by instalments of not less than 6*d*. per week for every pound or fraction of a pound borrowed. Every applicant for a loan must state the purpose for which the loan is required, and, if he offers only personal security, must get two friends of respectable standing to guarantee the repayment of the sum advanced, with interest thereon, in case of the borrower defaulting. The Bank receives deposits from 1*d*. upwards, and pays 3 per cent. per annum on the sum deposited, but no interest is payable until the deposits reach the sum of £1, and have remained on deposit for one month. On sums of £20 and upwards, deposited for six months, the rate of interest payable is 4 per cent. per annum.

Of the profits of each year, 20 per cent. is carried to the Reserve Fund of the Society; and a dividend not exceeding 5 per cent. may be declared on fully paid up shares. The remaining profits are at the disposal of the general meeting for the remuneration of officials or for educational purposes or otherwise. The reserve fund cannot be divided among the members, but may be made available by a resolution of the general meeting to cover deficiencies which may arise from unforeseen losses, and to serve as security for any loans which the Society may find it has to contract.

The history of the Society for the last four years is a record of steady progress. At the end of 1912 the number of members was 123, mostly allotment holders, small farmers, labourers, and small tradesmen, with a few friends of the movement; the number of shares issued was 202, and the paid up share capital was £184. The number of deposit accounts was 56, and the amount on deposit with the Society was £382. The number of loans granted during the last year was 46, and the amount was £611, which gives an average of £13 5*s*. 8*d*. per loan. The loans are generally required for the purchase of pigs, horses, or seeds, for general trading, or for fitting up houses for the season. They are usually repaid punctually, often before they are due; and only in two cases has it been found necessary to call upon the

sureties to make good the repayment of the loan. During the first ten months of the working of the Society, the accounts showed a net profit of only 18*s.* 6*d.*, and no dividend was paid. In the second year, the net profit was £10 15*s.* 2*d.*, of which £2 6*s.* 8*d.* was carried to reserve, a dividend of 2½ per cent. was paid to shareholders, and £6 was paid in honorariums to the officers of the Society. In 1911 the net profit of the year was £23 14*s.* 1*d.*, of which £4 14*s.* 10*d.* was carried to reserve, the full dividend of 5 per cent. was paid to shareholders, and £9 was granted in honorariums to the Society's officers. In 1912 the net profit of the year rose to £30 14*s.* 7*d.*, of which £12 16*s.* 4*d.* was carried to reserve, a 5 per cent. dividend was distributed to shareholders, and £12 allotted as honorariums. At the end of 1912 the Society possessed total assets amounting to £615, of which £612 were due by members on loans (about £50 of this being overdue), and its liabilities amounted to £573, of which £382 were due to depositors and £184 to shareholders. Thus on 31st December last the total net assets of the Society amounted to £42, and after paying the dividend and honorariums for the preceding year and writing off the balance of preliminary expenses, the Society was left with a sum of £20 carried to reserve, which represents the net profits of its working since its commencement, and is the property of the Society itself, on which it pays no interest.

One of the most satisfactory features in the Society's working is the gradual building up of this reserve fund, which forms a security against the reduction of the share capital owing to bad debts. The Society already feels itself in a position to reduce the rate of interest charged to borrowers in accordance with co-operative principles, and has resolved to allow a rebate equal to 1*d.* in the shilling on the total amount of interest received on loans which are repaid within forty weeks or less. This will encourage punctual repayment, and will enable the Society to lend out again more quickly money that is repaid in short periods. If the Society continues to show such satisfactory results, it may be hoped that it will soon be in a position to make loans to its members at a still lower rate

Thrapston and District Shire Horse Society.

This Society was founded at Thrapston, in Northamptonshire, in 1899, for the purpose of improving the breed of Shire horses in the district by obtaining the services of first-class registered sires. The annual subscription for membership is 5*s.*, payable in advance on January 1st in each year. The business of the Society is conducted by a President, Treasurer, Secretary, and Auditor, and a General Committee consisting of twelve members. At the annual meeting three members are chosen by ballot to select horses for the use of the Society for the ensuing year. Nominations of mares have to be sent in before April 1st, and are accepted in the order received until the subscription list is full. A nomination card is supplied by the Secretary to each member, specifying the number of mares entitled to be served and the time and route the horse will travel. No gratuities are payable to the groom in charge of the horse. The Committee are

not responsible for any damage that may occur during the time of trial or service.

During the last six years ending 1912, the average number of members has been 134, and the average number of nominations 214. Generally two horses are provided at different rates of fees, which have varied from ten guineas to £2, the number of nominations being usually restricted to 115 per horse. Last year the rates of fees charged were six guineas for the use of one horse and three guineas for the use of the other. For the current year, 1913, the Committee have provided two horses, (1) "Barn King," foaled in 1906, limited to 110 mares at five guineas, and open to non-members at seven guineas after April 14th; and (2) "Rolleston King," foaled in 1904, limited to 110 mares at two and a half guineas, and open to non-members at five guineas after April 14th. During the last six years the total amount of nomination fees payable has been £4,626, which gives an annual average of £771, and an average of £3 12*s.* per nomination, or almost exactly 1 per cent. on the average amount paid for the hire of a horse. The number of mares served during the last four years has averaged 110 per horse, the highest number being 115 and the lowest 104 The proportion of services which prove successful is estimated at from 60 to 80 per cent.

According to the cash account of the Society, the average annual expenditure for the last six years has been as follows.—

Hire of horses	£731
Secretary's honorarium	21
Selection expenses	14
Sundries	24
Total expenditure	£790

The income has averaged as follows:—

Membership subscriptions	£33
Service fees	771
Donations, interest, &c.	26
Total income	£830

so that on the average of these six years the Society has made a saving of £40 a year. The account shows a profit in five of the six years and a loss in only one.

According to the balance-sheet for the year ending March 8th, 1913, the Society had a balance in the bank of £296, and subscriptions and fees owing amounted to £27, so that the total assets were £323. Against this there were no liabilities, and the net assets of the Society have increased from £60 in 1906 to £323 at the beginning of 1913. That is to say, the Society has saved £263 in the last six years. This includes donations of £100 and £50 received from Lord Rothschild during the first two years of the period; but even excluding those donations, the saving on the Society's working for the six years has been £113, an average of £19 a year, which has gone to build up a reserve fund. Thus the Society has been more than self-supporting.

It is reported that the work of this Society has resulted in a marked improvement in the quality of the horses bred in the district, and has

enabled many members to sell young stock at good prices, and some to breed good stallions for themselves. Several horses, the offspring of the stallions provided by the Society, are now in the front rank.

To judge from this experience, a Society hiring two horses per season may expect to have an average annual expenditure, apart from the hire of the horses, of about £60 (£30 per horse), and to receive service fees for about 110 mares per horse; so that a membership subscription of 6*s*. per mare served would pay the expenses of management; and if the service fee was fixed at 1 per cent. on the amount paid for the hire of each horse, this would more than cover the cost of hire, and would provide for the building up of a reserve fund to meet casualties.

Hanmer Cow Insurance Society.

Hanmer is a rural parish in Flintshire, with an area of a little over 10,000 acres under crops and grass, of which more than 8,000 acres are under permanent grass. The chief farming industry is dairying, and there were in the parish in 1912 about 2,800 cows and heifers in milk or in calf, and 1,800 other cattle. There were approximately 260 holdings of above one acre, of which about 190 were under fifty acres.

As far back as 1862, a Cow Insurance Society was formed by the cow-owners of this and neighbouring parishes, for "the insurance and relief of each other who may have the misfortune to lose a cow or calf." The Society now consists of 274 members, and insures 1,014 cows and 262 calves; and is the second in point of numbers of all the Cow Insurance Societies in England and Wales. It insures its members' cows from death by disease or accident, and pays the full value—not exceeding £10—of any cow that dies. A heifer calf above six months old is insured for £2 until it is twelve months old, and then for £4 until it is sent to the bull; the usual practice being for a member owning a heifer calf to pay an extra shilling on the April quarterly night, and have his calf then reckoned as a cow, and marked as such on the horn, instead of on the hoof.

On the average of the last ten years,, of 914 cows insured annually, 22·4 died annually, which gives a death-rate of 2·5 per cent. per annum; of 229 calves insured annually, the number that died was 7·4 per annum, so that their annual death-rate was 3·2 per cent. For all the 1,143 animals taken together, the average annual death-rate was 2·6 per cent.; the lowest mortality in any year was 1·6, and the highest 3·4 per cent. in 1911, the excessive number of deaths in that year being due to several cows having eaten too many acorns in consequence of the dryness of the season and the scanty growth of grass. The amount paid on claims averaged for the ten years £244 per annum, or £8 4s. per animal that died. To cover this loss on 2·6 per cent. of animals insured would require an average net premium income of 4*s*. 3*d*. per animal insured. But the actual average income from premiums was only £191, or 3*s*. 4*d*. per animal insured, and even after adding to this an average of £13 from interest and £23 from sale of carcasses, the total income of the insurance fund averaged only £227 against the average payment of claims of £244, so that the insurance fund was depleted at the average rate of about £17 per

annum, and during the ten years the amount at credit of that fund actually fell from £597 to £429.

A member insuring a cow pays 1*s.* 6*d.* entrance fee and 1*s.* a quarter (that is, 4*s.* a year) premium; for a calf he pays 6*d.* entrance fee, and 9*d.* a quarter (or at the rate of 3*s.* a year) premium; but as a calf is usually insured as such for only half the year, from October to April, the actual premium paid per calf is generally only 1*s.* 6*d.* altogether. Other similar societies in the neighbourhood, charging the same rates of premium, find their insurance-funds increasing instead of diminishing, and, although the Hanmer Society has still £429 to its credit, almost enough to cover the average losses of two years, it behoves it to consider what is the cause of its less favourable experience, and what can be done to stop the depletion of its reserve fund. The main reason is obviously the higher death-rate, which at Hanmer is 2·6 per cent., while at Wem it is only 2·3, and at Prees and Whixall 2·1 per cent. per annum. If the Hanmer Society must expect the same experience in the future as it has had in the last ten years in the matter of average mortality, it would seem to be necessary to raise the rate of premium. Taking cows alone, the 50 that died in the years 1910 and 1911 cost the Society on the average £9 11*s.* per cow, and as the average death-rate of cows for the ten years was 2·5 per cent., it would require a net premium income of 4*s.* 10*d.* per cow to cover this loss. It would therefore seem advisable to raise the premium charged on cows from 4*s.* to 5*s.* a year, or from 1*s.* to 1*s.* 3*d.* per quarter. The 24 calves that died in those two years cost the Society almost exactly £4 each; the average death-rate among calves for the ten years was 3·2 per cent., but as a calf is generally insured during only half the year, from the time it is six months old till it is twelve months old, this mortality occurred during half the year, for which a calf paid a premium income of only 1*s.* 6*d.* altogether. To cover a loss of 3·2 per cent., costing £4 per calf, would require a net premium income of over 2*s.* 6*d.* during the half year instead of the 1*s.* 6*d* a calf at present paid; so that apparently, to cover the risk, the rate of premium per calf should be raised from 9*d.* per quarter to 1*s.* 3*d.* per quarter, the same as for cows; the smaller amount payable on the death of a calf being counterbalanced by the higher death-rate among calves (3·2 per cent. for the half year, or 6·4 per cent. per annum) as compared with that among cows (2·5 per cent.). Even if the Society raises its premium rate on both cows and calves to 1*s.* 3*d.* per quarter, equivalent to a rate of 5*s.* a year, it will still be insuring its members' cows at only one-third of the premium demanded by most live-stock insurance companies, which charge 7½ per cent. on the amount insured, or 15*s.* a year to cover a possible loss of £10.

While it seems probable that this enhancement of the rate of premium would have the effect of stopping the depletion of the reserve fund, and possibly of causing it to increase gradually, it is well to consider whether something cannot be done to lower the death-rate, or to provide against it. Unlike most of the societies, this Society has the salutary bye-law that "members must have all their cows and calves in, or none," so that it is not possible for a member to get only his doubtfully sound animals insured, and avoid paying premiums on the thoroughly sound animals; but it has laid down no limit as

to the number of animals a member may possess and insure, so that several members have insured more than 15 animals, and one as many as 30. There seems some reason to expect that the rate of mortality will be higher in a large herd kept together on one farm than among an equal number of animals, each kept separately by a cottager always under its owner's close supervision; and if that is so, it would only be fair that the owner of a large herd should pay a higher rate of premium than the owners of one or two animals. An examination of the statistics of the Society for the nine years 1903–11 corroborates this impression. It is found that during that period the death-rate for owners insuring less than ten animals each was only 2·6 per cent. per annum, while for owners insuring ten or more animals each it was 2·9 per cent. In the neighbouring Whixall Society, insuring on the average 1,302 animals every year, the corresponding figures are 1·9 per cent. for owners insuring less than ten animals, and 2·4 per cent. for owners insuring more than ten animals. The following statement, which compares for the Hanmer Society the mortality experienced during the nine years 1903–11 as between (1) members who insured ten or more animals, and (2) members who insured less than ten animals, shows that during that period the Society paid on the average, on the number of animals insured, 4*s*. 8*d*. per annum to the larger farmers, while it only paid 4*s*. 3*d*. to the smaller men.

	Society as a whole	Members insuring ten or more animals	Members insuring less than ten animals
Number of animals insured	10,150	2,964	7,186
Number of animals that died	269	85	184
Death rate per annum	2·7	2·9	2·6
Total compensation paid by Society	£2,213	£686	£1,527
Compensation paid per animal insured	4*s*. 4*d*.	4*s*. 8*d*.	4*s*. 3*d*.

It might therefore be suggested that, while owners of less than ten insurable animals altogether should pay a premium at the rate of 1*s*. 3*d*. per quarter per cow or calf, the rate should be raised to 1*s*. 6*d*. per quarter for all owners of more than ten insurable animals, who have not been members for more than five years.

One reason for the comparatively high death-rate may be that the Society's operations extend over too large an area. Most agricultural co-operative societies allow membership only to persons residing within easy reach of each other, so that the members know each other personally, and the committee and office-bearers have no difficulty in exercising supervision, in which they are assisted by their fellow members. The Hanmer Society undertakes the insurance of cows over an area so large that a steward may have seven miles or more to go to mark an animal as insured or to see one that is ill, and it is impossible for the steward or the members of the Committee to form as satisfactory a judgment as they could, had they closer knowledge of the men and animals with which they have to deal. If the Society refused to take in any new members resident more than, say, four miles from its headquarters, or divided itself into two or three smaller societies, its members might find that greater knowledge and care would result in a lower death-rate. However, the Whixall Society,

with an area approximately as large, has an average death-rate of only 2·1 per cent. per annum, and it is possible that the Hanmer area may be a more unhealthy one for cows, and that this may be the cause of a higher mortality from tuberculosis, which is the worst enemy of the Society; if that is so, the Hanmer cow-owners must be content, until they can get rid of tuberculosis, to pay a correspondingly higher premium than their Whixall neighbours.

The Society is managed by three trustees, a committee of four members, a treasurer and a secretary. The secretary, who is the village carpenter, receives a salary of £9. There are four stewards, who have the responsible duties of marking animals as accepted for insurance, of valuing animals that fall ill, and of certifying claims against the Society's funds. In serious cases a second steward is called in, and when the stewards are doubtful about any question, a special meeting of the committee is summoned. A steward is paid 3*d*. by the owner for every animal he marks, and as the distances he has to travel are often great, he receives from the Society 1*s*. 6*d*. for every journey he has to make to see an insured animal that has fallen ill or met with an accident. These travelling expenses may amount to as much as £16 in a year, and the total costs of management have, for nine years, averaged £27 13*s*., or about 6*d*. per animal insured; they are met by a levy on members, separate from the premium contributions.

Although the reserve fund has been decreasing in recent years, and it is therefore advisable to take action for the purpose of strengthening it, the fact remains that it still amounts to £429, and that the Society has been able for fifty years to insure its members against loss of their cows from disease or accident, on payment altogether of the very low charge of 4*s*. 6*d*. per cow per annum, and has thus given them all a valuable sense of security, and saved many of them from what would otherwise have been crippling losses.

An Example of a Prussian Agricultural Co-operative Credit Society.

A very instructive account of the progress of an agricultural co-operative credit society in Prussia is given in the *Deutsche landwirtschaftliche Genossenschaftspresse*, June 15th, 1913. The society in question was founded in November, 1900, in the two communities of Herrenhofen and Orschkau in Posen, possessing an area of 2,700 acres and a population of about 600 persons. These two communities were established by the Settlement Commission of West Prussia and Posen, and the inhabitants were drawn from all parts of Germany and even Russia and Galicia, so that the success which has attended the working of a society composed of members with different customs and ideas is all the more creditable. The first settlers came to the district in 1900, whereupon the society was commenced with 19 members. It is recorded that none of the members had previously heard of a co-operative credit society, and were exceedingly mistrustful of each other. The society, however, increased until in 1905 there were 64 members, by which year the settlement scheme was completed. At the end of 1911 the society had 72 members, of which 52 were peasants, and the rest artisans, agricul-

tural labourers, teachers, &c. The members' holdings are either small or of a medium size, and no large landowners belong to the society. Three members have from 74 to 86 acres, and the others have from 25 to 50 acres, with the exception of a few who have very small holdings or no land at all.

Deposits.—Very little of the savings of the members were at the disposal of the society in the first years of its existence, as the members were engaged in equipping their holdings. Thus in 1901 the society had £150, and in 1906 £875 in deposits, but thereafter greater progress was made, and the amount owing to the members by the society in deposits in 1911 was £3,800. There were 208 deposit accounts in 1911, compared with 6 in 1901. There are thus three times as many accounts as members. Much trouble has been taken to induce servants and children to invest their savings with the society, all amounts, however small, being accepted. Nearly all the members have a deposit account.

Loans.—Most, if not all, of the members, did not have sufficient funds to fully equip their holdings, and in addition the harvests in the first two years were very poor, so that the loans made by the society were much valued. In 1901, 8 loans were made of the value of £140; in 1902, 7 of the value of £215; in 1903, 18 of the value of £525; and in 1904, 56 of the value of £1,680. After 1904 the loans decreased both in number and amount, as, by then, most of the holdings were provided with the necessary buildings and stock, and further loans were thereafter required by farmers principally for increasing their activities. In the eleven years 1901–11, 214 loans in all were made, of the value of £7,065, of which £4,925 had been paid back by the end of 1911. It is stated that, but for the facility with which these loans could be obtained, many of the farmers would have fallen into the hands of moneylenders.

The members made little use of current accounts in the first few years. The sale society, through which the members dispose of their animals, pays by cheques on this co-operative credit society, these amounting in 1911 to £1,650. The total deposits of members on current account in 1911 were £15,000.

Co-operative Purchase and Sale of Produce.—The funds of the co-operative credit society have been available for the purchase of manures, feeding stuffs, seeds, &c. This is the most important branch of the society's work. The amounts purchased in various years were as follows:—

	1901	1905	1908	1911.
	tons.	tons	tons	tons.
Manures	44	156	212	280
Feeding Stuffs	11	123	208	460
Coals	85	187	400	415
Seeds	1	4	15	20
Total	141	470	835	1,175
Valued at ...	£290	£1,620	£3,200	£5,150

Besides these, the agricultural machinery purchased has averaged from £100 to £200 yearly in value. The large increase since 1905 (after which year the number of members remained constant) is to be ascribed to the fact that the farmers had realised that where better yields and prices were obtained for their corn and live-stock, these were due to better seed, manures and feeding stuffs, and that superior quality materials at comparatively low prices could be obtained by co-operative purchase. The increase in the purchase of feeding stuffs from 208 tons to 460 tons yearly between 1908 and 1911 was a direct result of the members joining a dairy society.

The increased milk production from the cows led to a greater amount of separated milk being left at the disposal of the members, which in turn led to an increase in the number of swine kept. In 1911 the milk sold to the dairy society realised £2,805, and the swine (more than 700 in number) disposed of by the sale of animals society brought in £3,285.

Special care was taken to secure the best seed, and improved varieties of rye (Petkus) and oats (Ligowo) have been brought to the notice of the members. All the goods delivered to the members have been accompanied by the relative guarantees.

In 1902, for the purpose of the sale of corn, the society was affiliated to the *Deutsches Lagerhaus* in Posen, and at present practically all the corn of the members is disposed of in this way, at much better prices than were formerly obtained individually from merchants.

Profit.—The society has steadily made profits over its transactions, the profits in the last few years averaging £50 or more, and the reserve fund has gone on increasing. It is now the object of the society not to increase its reserve further, but to grant to its members more favourable conditions as regards loans, interest on deposits, and sale and purchase of goods. The total transactions of the society and its net profit in various years were as follows:—

	Total Transactions.	*Net Profit.*
	£	£
1901 ..	4,756	11
1905	16,018	58
1908	38,360	61
1911 . .	56,850	55

Its reserve fund at present is £540. In addition it has fixtures, &c., which were purchased for £200, but which have been written down to £11.

Members' Capital.—About 6,840 tons of goods were purchased, and 3,675 tons of corn sold between 1901 and 1911. To purchase the goods, loans had to be obtained in the first years from the Posen Agricultural Credit Bank, but as the deposits made in the society increased, these were gradually utilised in place of loans. The capital of the society was very small, each member paying only 10*s*., but in 1911 it was decided to raise each member's capital to £5 and to allow interest on it, at a rate, however, not exceeding that granted on deposits.

Estimate of the Amount Saved to Members by the Society.—The total purchases of manures, feeding stuffs, coal, seed and machinery,

and sales of corn were 10,515 tons (the sales of milk and animals, not being carried out by this society, are not taken into account in these estimates). If the exceedingly small amount of 1·2*d.* (*i.e.*, 10 pfg.) is reckoned as saved to the members on each hundredweight of goods purchased, and a price higher by 1·2*d.* per cwt. is reckoned as obtained by the co-operative sale of corn, the total savings would come to £1,050; the savings on machinery (3 per cent. on £1,500) were £45. The interest received by the society on loans was £2,200, but the rate charged would have been at least 1 per cent. higher if the members had borrowed elsewhere, and £440 was saved in this way. Adding to these amounts the present reserve, the total savings at these extremely moderate estimates amount in the 11 years to over £2,000.

The Co-operative Re-insurance of Animals in France.

Attention has already been drawn in this *Journal* (June, 1913, p. 255) to the efforts of the French Ministry of Agriculture to extend the principle of re-insurance among agricultural co-operative societies. A special section of the Ministry has been created, dealing with questions relating to co-operation and credit, and a re-insurance institute of the third degree, the *Fédération Nationale de la Mutualité et de la Co-opération Agricoles,* has been established, supported by State aid

The Departmental live stock re-insuring unions hold an intermediate position between the local live stock insurance societies and this National Federation, inasmuch as the local societies insure with these unions, which, in turn, insure with the National Federation. By May 31st, 1912, 20 unions had re-insured with the National Federation, their re-insured capital being £2,400,000. In an article in the *Annales de la mutualité et de la Co-opération Agricoles,* for April, 1913, the President of the Re-insuring Union of the Department of Rhône expresses the view that this system of re-insurance, from the simplicity of its working and the absolute security it offers to agriculturists, greatly facilitates the co-operative insurance of animals.

An account of the working of the system is given. The local societies in the Department, on the death of the animals of their members, pay 80 per cent of their value A proportion (this may be one-third, half, two-thirds, or three-quarters) of the sum represented by this 80 per cent. is then re-insured by the local societies with the Departmental Union to which they are affiliated, the premiums charged by the Union to the Societies being a proportion (one-third, half, two-thirds, or three-quarters) of the premiums charged by the local societies to their members The Re-insuring Union of Rhône, in its turn, re-insures with the National Federation 70 per cent. of the amount re-insured with the Union by the local societies.

To take a concrete example, suppose a member of a local society insures with the society a cow valued at £16 Then the society is liable to pay 80 per cent., viz , £12 16*s.*, on the death of the animal; the Re-insuring Union will have to pay three-quarters (if, say, this proportion had been arranged) of £12 16*s.*, viz., £9 12*s.*, to the local society; while the National Federation would pay 70 per cent. of £9 12*s.*, viz., £6 14*s* 5*d.*, to the Re-insuring Union. The net result

would be that, of the £12 16*s.* paid to the owner of the cow, £3 4*s.* would be paid by the local society, £2 17*s.* 7*d.* by the Re-insuring Union, and £6 14*s.* 5*d.* by the National Federation.

The minimum insurance premium which may be charged by the local societies is 1 per cent. of the value in the case of cattle, 1·6 per cent. in the case of horses, asses, and mules, and 2 5 per cent. in the case of brood mares; but in order to guard against the local societies charging premiums which are not sufficient to cover losses, societies having a deficit on their working are bound to raise the insurance premiums to an amount sufficient to cover a loss equal to that of the average of the three preceding years; but the premium must not exceed 2 per cent. of the value in the case of cattle, 3 per cent. in the case of horses, asses, and mules, and 3·5 per cent. in the case of brood mares. The three classes of animals must be kept quite distinct with regard to premiums and calculations of losses.

If the typical local society mentioned above had 100 head of cattle insured by members, its financial position at the time of its constitution would be approximately as follows :—

Receipts.	£	s.	d.
Entrance fees for 100 cattle at 4 4-5*d.* (*i.e.*, ½ fr.)	2	0	0
Premiums at 1 per cent. on total value of £1,600 ..	16	0	0
Special contribution from members in respect of expenses of formation	20	0	0
Total ..	£38	0	0

Expenditure.	£	s	d.
Expenses of formation	1	12	0
Premium charged by re-insuring Union (three-quarters of premiums charged by local society) .	12	0	0
Total .	£13	12	0

The local society would thus be left with a working capital of £24 8*s.*

The net amount the society would have to pay on the death of an animal would be £3 4*s.*, so that, even in the first year of its formation, it could meet a death-rate of 8 per cent among the animals, the average death-rate among cattle being about 1·4 per cent. The allowance for the hides, &c., of animals that died would put the society in an even more favourable position.

The local societies are self-governing under the control of the Departmental Re-insuring Union; but before they are affiliated their regulations must provide for the minimum premiums, and for the raising of these premiums in certain cases as mentioned above. On the death of an animal the various bodies know immediately the extent of their liabilities, and the Re-insuring Union can pay its share without the local society having to draw upon its reserve fund or ordinary annual funds.

OFFICIAL NOTICES AND CIRCULARS.

Research Scholarships in Agricultural Science.

The Board of Agriculture and Fisheries have awarded Research Scholarships in Agricultural Science of the annual value of £150, tenable for three years, to the following candidates, viz. :—

E. W. Barton, B.A. (Wales), Economics of Agriculture.
W. Brown, M.A., B.Sc. (Edinburgh), Plant Pathology.
Miss E. C. V. Cornish, M.Sc. (Bristol), Dairying.
F. L Engledow, B.Sc. (London), B.A., University Diploma Agriculture (Cambridge), Genetics.
E. J. Holmyard, B.A. (Cambridge), F.C.S., Plant Nutrition and Soil Problems.
R. G. Knight, B.Sc (London and Bristol), Plant Physiology.
F. J. Meggitt, B.Sc. (Birmingham), Agricultural Zoology.
H. Raistrick, B.Sc. (Leeds), A.I.C., Animal Nutrition.
G. O. Sherrard, A.R.C.S. (Dublin), Genetics.
T. Trought, B.A. (Cambridge), Genetics.
G. Williams, B.Sc. (Wales), Animal Nutrition.
S. P. Wiltshire, B.Sc. (Bristol), Plant Pathology.

They have also awarded Miss T. Redman, B.Sc. (London), a scholarship in Dairying, tenable for 2½ years, to fill a vacancy caused by the resignation of a former scholar.

The scholarships have been established in connection with the scheme for the promotion of scientific research in agriculture, for the purposes of which the Treasury have sanctioned a grant to the Board from the Development Fund, and they are designed to provide for the training of promising students under suitable supervision with a view to enable them to contribute to the development of agricultural science.

Wart Disease of Potatoes.—Warning.

The Board of Agriculture and Fisheries desire to inform potato-growers that cases of Wart Disease of Potatoes (*Synchitrium endobioticum,* Percival) have occurred in Lancashire, and to remind them that by Article 3 of the Wart Disease of Potatoes Order of 1912 they are required to report the presence of this disease on their premises to the police or other officers appointed by Local Authorities for the purpose, and that failure to report is punishable by a fine. Notifications may be sent to the Board, who will forward them to the proper quarter.

A leaflet describing the disease and giving directions for dealing with it can be obtained from the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W., gratis and post free. Letters so addressed need not be stamped.

Rural Housing.

The Board of Agriculture and Fisheries wish it to be made known that they are desirous of obtaining information upon the subject of the erection of rural cottages for labourers and others. They will be grateful if any landowners or local authorities who have recently erected such cottages will furnish them with particulars of the cost

of the cottages, and the results of their enterprises, both financially and otherwise.

A form of particulars will be sent, on application, to any person who is willing to supply such information.

Communications should be addressed to The Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W., and need not be stamped.

Prices of Agricultural Produce.

Part III. of the Agricultural Statistics for 1912, dealing with prices and supplies of corn, live stock, and other agricultural produce in Great Britain, has been published by the Board [Cd. 6906, price 5*d.*]. Reporters were appointed by the Board in four further towns in 1912, viz., Taunton, King's Lynn, Penrith, and Gloucester, so that returns from these towns are now included in this part of the Agricultural Statistics. The tables are prefaced by a report discussing the changes in the prices of corn, fat stock and meat, store stock, milk, dairy produce, wool, vegetables, fruit, hay and straw, and hops.

Progress of the Ordnance Survey.

The Report of the Director-General of the Ordnance Survey for the year ended March 31st, 1913, has been recently published [Cd. 6903, price 1*s.* 6*d.*]. The principal feature of the work of the Ordnance Survey for the year is that the survey of Ireland on the scale of $\frac{1}{2500}$ (25 34 inches to 1 mile) was finished so far as the field work is concerned. The great bulk of the survey is published, and the whole will have been printed by the end of December, 1914. The whole of the United Kingdom, with the exception of waste and mountainous areas, has now been surveyed on the $\frac{1}{2500}$ scale. The United Kingdom is the only country in the world of which large scale cadastral maps are available for the whole cultivated or occupied surface.

Small Holdings and Allotments Act, 1908. Equipment.

The Board have addressed the following circular letter, dated July 17th, 1913, to County Councils and Councils of County Boroughs in England and Wales :—

SIR,

I am directed by the Board of Agriculture and Fisheries to invite your attention to the Report of the Departmental Committee on Buildings for Small Holdings [Cd. 6708] which has recently been issued.

The question of the character and cost of the equipment of small holdings is one that the Board regard as being of vital importance, affecting as it does very largely the success or failure of the holding concerned. The interests of the occupier demand that he should not be burdened with an excessive annual payment in respect of buildings provided for his use; while, on the other hand, the interests of the ratepayers require that the outlay on the equipment of their property should be expended prudently, in order to avoid, as far as possible, the risk of subsequent loss. The Board themselves are also concerned in the matter, inasmuch as they are liable for part of any loss incurred in carrying out a scheme approved by them.

For these reasons the Board desire to impress on the authorities interested the need for exercising the greatest care in formulating their proposals for the equipment of properties acquired by them. The Board recognise that in some cases Councils are fully alive to the need for strict economy in equipment, and they appreciate the great care taken in many instances to eliminate every item of unnecessary expense. But, on the other hand, it has appeared to the Board that many of the schemes of equipment that have been placed before them have afforded no evidence of a determined attempt to keep the outlay involved within reasonable limits, or of an adequate appreciation of the fact that a type of equipment and scale of expenditure suited to a large farm are not appropriate for a small holding, and more especially for one provided by a public authority, who are under the obligation to fix the rent of the holding strictly in proportion to the cost of providing and equipping it. In this connection it may be pointed out that prospective tenants, in their desire to obtain land, may be induced to offer to pay rents that would recoup even an excessive expenditure on equipment, but which a few years' experience would show could not be maintained and in such cases loss must eventually ensue.

The whole question of equipment is discussed fully in the Report of the Committee, and the Board do not propose to recapitulate the considerations put forward therein. I am, however, to say that the Board have decided that in future they will examine proposals for the equipment of small holdings in the light of that Report, and both in regard to the accommodation to be provided and to the amount of expenditure generally, they propose to adopt the Report and the plans appended thereto as the standard by which to judge of the reasonableness of schemes of equipment that may be submitted to them.

The Board have found in the past that Councils have often proceeded on the assumption that their plans will be approved without amendment as a matter of course, and that they have let the contracts and in some cases allowed the work to be commenced, before the Board's approval has been obtained. The Board strongly deprecate this practice as making it difficult, if not impossible, to adopt modifications that they may suggest. In future the Board intend to scrutinise closely any proposals for equipment that may come before them, and they will not hesitate to withhold their approval of proposals which, in their opinion, go beyond the requirements of the case, or involve an excessive outlay. It should be clearly understood that Councils cannot obtain sanction to the raising of loans for works of adaptation until the Board have informed the Local Government Board that they have approved the works, and it is therefore of the first importance that no work should be put in hand before the approval of the Board has been obtained. Difficulty and delay in obtaining the Board's approval will be avoided, if Councils will adopt, so far as possible, the plans and recommendations of the Departmental Committee, and I am also to suggest that wherever possible the Council should confer with the Small Holdings Commissioner for the district before their plans for the subdivision and equipment of land acquired for small holdings are finally settled and submitted to the Board.

I am to add that the fact that the Board may have approved certain plans for houses or buildings in the past must not be taken as any guarantee that similar plans will be approved in future.

The Board are aware that the cost of building at the present time is alleged to be considerably higher than for some years past, and this circumstance, as well as others of a local or special character affecting any particular scheme, will be taken into consideration when dealing with the Council's proposals.

The Report of the Committee is obtainable either directly or through any bookseller, from Messrs. Wyman and Sons, Ltd., Fetter Lane, London, E.C., price 1*s.* 6*d.* exclusive of postage.

Terms of Loans.

I am also to inform you that as a result of the Report of the Departmental Committee on the Duration of Buildings on Small Holdings [Cd. 6536] the Local Government Board have agreed, at the request of this Department, to extend the terms allowed for loans for certain works of equipment. The terms that the Local Government Board have allowed hitherto, and the extended terms which they have intimated their willingness to allow in future, are shown in the following statement:—

Description of Work.	Term now allowed Years	Extended term Years
FENCING—		
Creosoted under pressure .	15	20
Stranded wire with special steel or wrought iron standards and substantial steel or wrought iron straining posts	20	25
Continuous bar iron (according to strength)	15 to 20	25
Dry stone walling .	20	25
DRAINAGE (LAND)—		
Pipes	20	25
BUILDINGS—		
Stud and weatherboarded (creosoted or otherwise chemically treated under pressure), on brickwork in mortar, or masonry in mortar, or concrete pinnings roofed with ruberoid, or timber (creosoted or otherwise chemically treated under pressure), provided the brickwork in mortar, or masonry in mortar, or concrete support is carried 18 inches above the surface of the ground	20	25
Do. roofed with corrugated iron 20 B W.G	20	25
Do do. 22 B W.G.	18	25
Do roofed with tiles or slates	25	35
Do. if not on brickwork or masonry or concrete pinnings ...	15	20

The Board have sent a copy of this Circular to your Council's Small Holdings Officer, and they will be glad to supply further copies if desired.

I am, &c.,

SYDNEY OLIVIER,
Secretary.

Inquiries are frequently addressed to the Board for information as to the whereabouts of Awards under Inclosure Acts passed prior to the General Inclosure Act of 1845.

Memorandum as to the Custody of Inclosure Awards.

2. All awards under the Act of 1845 are in the custody of the Board, and copies thereof are deposited with the Clerk of the Peace for the County concerned, and also with the Churchwardens of the

parish or their successors in title. A list of all such Awards made up to the year 1893 is contained in a House of Commons Return (455 of 1893). Awards made under Acts passed between the General Inclosure Act, 1801, and the Inclosure Act, 1845, were, in the absence of other provision in the authorising Act, to be enrolled in one of His Majesty's Courts of Record at Westminster, "or" with the Clerk of the Peace for the County; inquiries as to their present place of deposit and as to opportunity of inspecting them may be addressed to the Public Record Office, Chancery Lane, London, W.C. The place of deposit of Awards made under Acts prior to, or not governed by, the General Inclosure Act, 1801, can be discovered only by an examination of the provisions of each Act. In many cases these private Acts were not printed, and it would probably be difficult to discover any existing copy of the Act. Lists of local Inclosure Acts from 1727 to 1834 are contained in George Bramwell's Analytical Table of Private Statutes (2 Vols., London 1813 and 1835). Reference to the Index of Local Acts, 1801–1899 (H M. Stationery Office: 1900) may also be useful in an endeavour to trace information

3. It will be seen that considerable difficulty may be experienced in ascertaining the present location of Awards of Inclosure bearing date prior to 1845 Many of them are included in the House of Commons Return (No. 50 of 1904) of Inclosure Awards deposited with Clerks of the Peace or Clerks of County Councils, who may possibly in certain cases be in a position to supplement the information contained in that Return. Where this source of information fails, the Board may sometimes be able to furnish the name of the present custodian by reference to the Ordnance Survey Department, who have consulted very many Inclosure Awards in connection with the ascertainment of parochial boundaries. Information may also be available in some cases from the Steward of the Manor or from the Parish Council or Incumbent of the Parish concerned, or from Diocesan Registrars or Chapter Clerks.

4. A certain number of Inclosure Awards, or copies thereof, are in the custody of the Public Record Office, the Duchy of Lancaster Office, His Majesty's Commissioners of Woods and Forests, and the Ecclesiastical Commissioners At the Public Record Office are kept those Awards which were transferred from the Royal Courts of Justice, as well as those transferred with the Land Revenue Records from the Office of Woods and Forests. The Commissioners of Woods and Forests have information only as to the whereabouts of such Awards as affect Crown property.

5. A very few Awards relating to lands in Middlesex are in the keeping of the Land Registry, Lincoln's Inn Fields, London, W.C., as successors to the Middlesex Registry of Deeds; and many relating to lands in Yorkshire (East, North, and West Ridings) are at the Registries of Deeds at Beverley, Northallerton, and Wakefield respectively. There is reason to believe that some Inclosure awards have found their way into private hands, while a small number are understood to be included in the collections of Manuscripts at the British Museum.

Advisory Council on Light Horse Breeding.

A meeting of the Light Horse Breeding Advisory Council of the Board of Agriculture and Fisheries was held on Monday, July 7th, at the offices of the Royal Agricultural Society of England, 16, Bedford Square, W.C., under the chairmanship of Lord Middleton. Among those present were Viscount Helmsley, M.P., the Hon. Alexander Parker, Colonel the Hon. Charles Byng, Sir Merrik R. Burrell, Bart., Major-General J. F. Brocklehurst, C.V.O., C.B., Major A. L. Langman, C.M.G., Captain M. S. Adye, Mr. Tresham Gilbey, Captain John Gilmour, M.P., Mr. J. L. Nickisson, Mr. J. F. Lort Phillips, Mr. W. Phillpotts-Williams, Mr. G. G. Rea, Mr. J. Sewell Rigg, Mr. R. S Tilling, Mr Robert Whitehead, and Professor John Penberthy.

The Board were represented by Mr. E. J Cheney (an Assistant Secretary), Mr. J. McCall (Assistant Veterinary Officer), Mr. F. W. Carter (Superintending Inspector), and Mr. E. B Shine.

Mr. E. B Wilson and Mr. A B Charlton (Joint Secretaries to the Council) were also present.

Apologies for non-attendance were received from H R H Prince Christian of Schleswig-Holstein, K G , the Earl of Dalkeith, the Earl Fortescue, K C.B , A.D.C , Mr Algernon Turnor, C.B., Lieut.-Colonel J. McKie, Mr G. Norris Midwood, Captain Dealtry C. Part, Mr. George Scoby, Mr C W Tindall, and Mr. Romer Williams

The Chairman announced the appointments of Mr. Romer Williams and Mr George Scoby as members of the Council, and, on the motion of the Chairman, these gentlemen were elected to serve on the Standing Committee.

The Chairman submitted to the Council a Report of the Proceedings of the Standing Committee since the last meeting of the Council. Mr Cheney explained that the majority of the recommendations of the Committee had been adopted by the Board, that some of them were still under consideration, and that in only one instance were the Board unable to agree with the recommendations made. The reasons for this were given to the Council and accepted by them, and on the motion of Mr. J. L. Nickisson, seconded by Colonel the Hon. Charles Byng, the report was adopted by the Council with the exception of the one recommendation referred to.

Mr. Cheney, in giving an account of the Board's horse-breeding operations, called particular attention to the fact that the object in view was to secure an improvement in the *quality* of the horses bred, and not primarily to induce farmers to breed light horses for remount purposes, a business which was not sufficiently remunerative. He also wished to correct an idea which seemed to prevail that the Board had a lien on the progeny of mares to which free nominations had been awarded; the Board had no such claim, and would be glad if publicity were given to the fact.

The results of last year's service season and of the present one, up to date, were reported to be satisfactory, as was also the class of stallions exhibited for King's Premiums in March last.

The registration of stallions was being well taken up throughout the country. Up to date, 825 stallions had been registered as against 715 in 1912, and as this number was exclusive of stallions registered in Scotland, the returns were encouraging. The Board had decided

to amend their registration regulations so as to allow two appeals instead of one, and to confine the certificate of the examining veterinary surgeon to the soundness of the stallion, the question of its suitability being left for determination, if necessary, by a conformation judge appointed by the Board.

Mr. Cheney also made reference to a report that is being prepared on the particular needs of each county, so as to enable the Board to reconsider what re-allocation of the grant is desirable in the various parts of the country.

In the course of a general discussion, Major-General J. F. Brocklehurst moved the following resolution :—

> "That thoroughbred stallions should be exempted from examination for wind at six years old, if passed for registration at that age, and if they had been placed first, second, or third as three year olds or over in any race under the rules of racing,"

and urged its adoption on the ground that if a stallion had undergone a severe training on the racecourse and had remained sound up to six years of age, the question of the development of unsoundness subsequently was of little moment, as the stallion would still be a good horse and worth buying.

A lengthy discussion followed, the resolution being opposed by Lord Middleton, Mr. G. G. Rea, Captain Gilmour, and Mr. Alexander Parker, and on being put to the meeting it was lost by a large majority.

Other matters discussed were the Brood Mare Scheme, the Purchase of Stallions by the Board, and the award of Super-Premiums, in which Mr Lort Phillips, Mr. G. G. Rea, and Mr. Sewell Rigg took part.

Appointment of Live Stock Inspectors.

The President of the Board of Agriculture and Fisheries proposes to appoint two Inspectors in connection with the administration of the Board's scheme for the Improvement of Live Stock.

The salaries, exclusive of travelling expenses, will be one of £500 and one of £600 a year, rising in each case by annual increments of £20 to a maximum of £700 Applicants must possess a thorough practical knowledge of stock-breeding.

Applications should be addressed to The Secretary, Board of Agriculture and Fisheries, 3, St. James's Square, S.W., from whom forms can be obtained, and should reach the office of the Board not later than August 18th.

It is unnecessary for those persons who have already communicated with the Board to renew their applications.

MISCELLANEOUS NOTES.

The Tenth International Agricultural Congress was held at Ghent from the 9th to the 15th June.

The International Agricultural Congress at Ghent.

The formal opening of the Congress took place at Brussels on the 9th June, but all the subsequent meetings were held in the Palais des Congrès, a building within the grounds of the International Exhibition, which is now being held at Ghent. Great Britain was represented by Sir Sidney

Olivier, Secretary to the Board of Agriculture and Fisheries, Mr. T. H. Middleton, Assistant Secretary, and by Sir James Wilson and Mr. A. B. Bruce, Superintending Inspectors.

The Congress was opened by M. Méline, late President of the Council of Ministers, France, who in his address dealt with the subjects of Rural Depopulation and the Rise of Prices of Agricultural Products. Thereafter the principal delegates had the honour of being presented to His Majesty the King of the Belgians.

On the succeeding three days the Congress was divided into five sections under the following headings :—

(1) Rural Economy.

(2) Education and Agricultural Science.

(3) Live Stock.

(4) Agricultural Engineering and Reclamation

(5) Forestry.

Section 1—that concerned with Rural Economy—was the best attended, a discussion on rural depopulation, in particular, exciting much local interest and eliciting a great diversity of opinion as to the best remedies for the evil.

The last three days were occupied by visits to places of agricultural interest in Belgium, such as the "Polder" (reclaimed) lands on the sea coast, and the Agricultural College at Gembloux.

The success of the Congress—which was undoubted—was largely due to the labours of M. P. de Vuyst, Director-General of Agriculture, Belgium, to whose unfailing tact and courtesy the members of the Congress are much indebted. The members were also under great obligations to M. Maurice Lippens, Vice-President of the Committee charged with the arrangements for excursions and receptions.

The Correlation between the Percentage of Milk Fat and the Quantity of Milk Produced by Ayrshire Cows.

With the present number of the *Journal*, the Board publish as a Supplement* (Supplement No. 11, price 4*d*. post free) a report on the Correlation between the Percentage of Milk Fat and the Quantity of Milk produced by Ayrshire Cows. The investigation was undertaken by the Board owing to a desire for figures showing as definitely as possible the extent of the correlation between the quantity and quality of milk yielded by a cow. The work of preparing a report on the subject was entrusted to Mr. H. D. Vigor, an Assistant to the Head of the Statistical Branch of the Board. It was thought desirable to include in the calculations such other variable factors as might affect the milk yield of the cow and the percentage of fat contained in the milk, and for this reason it was decided to deal also with the age of the cow, the duration of lactation and the date of calving. The conclusions are derived from data contained in a Report of the Ayrshire Cattle Milk Records Committee.

The conclusions drawn are that :—(1) After allowance has been made for the varying age and duration of the lactation period of the Ayrshire cows under examination, the milk of cows which gave the larger average weekly yields of milk shows a definite and appreciable tendency to be poorer in milk fat than the milk of cows which gave lower average weekly yields.

* This Supplement will be supplied free to subscribers on written application.

(2) The duration of lactation had no significant influence upon the average percentage of milk fat produced.

(3) The percentage of milk fat showed a slight, but definite, tendency to be lower in the older than in the younger cows, after due allowance has been made for the average weekly yield of milk.

(4) Taking the herd as a whole, the duration of the lactation bore no relation to the average weekly yield of milk produced by cows. There is thus no evidence, in the case of these cows, of a selective action in favour of retaining in milk those cows that gave a better average yield of milk than others.

(5) In the herd under examination, the older cows show a definite and appreciable tendency to give larger yields of milk than the younger cows. This may possibly be due partly to a selective action in weeding out cows which proved unpromising as regards their milk yield when young, and partly to a physiological tendency for older cows to give better yields than younger ones.

(6) The duration of lactation has possibly tended to be longer in older than in younger cows, although the evidence on this point is not quite definite.

If it is supposed that the average age and duration of lactation remain unaltered, it appears possible to select a herd with an average yield of nearly 800 gallons per cow per lactation (as compared with the 1909 average yield of 637 gallons), without reducing the average percentage of milk fat produced in the herd as a whole below 3·58 per cent, as compared with the present average of 3·68 per cent. It must be borne in mind, however, that while this result may be regarded as the most probable, in the long run the certainty of attaining it diminishes when only a small number of cows is being dealt with, and increases proportionately with the number of cows in the herd in which the policy of selecting cows with higher milk yields is pursued.

Importation Regulations.

Importation of Potatoes into South Africa.—The documentary requirements respecting the importation of potatoes into the Union of South Africa during the season 1913–14 remain as they were for the previous season.* Regulations, recently issued, provide that:—

No person shall introduce into the Union any articles in any consignment of potatoes which appear, by the evidence of accompanying documents, or by being contained in similar boxes, bags, or other receptacles, to have originated in the same district as an article contained in the consignment found to be infected with wart disease. If in any package any pathogenic bacterial disease, or other disease on account of which potatoes are not admitted, is found to exist, that package and also all packages bearing the same marks in which 15 per cent of the tubers are decayed will be excluded from entry. Packages in which under 15 per cent. of decayed tubers are found will be passed providing no trace of the bacterial disease is found in them.

All consignments will be inspected and will be fumigated with formaldehyde gas, usually without removing the potatoes from their containers. For this reason packing material such as wood, lime, cork dust, and paper will be removed from the boxes, &c., and ventila-

* See *Journal* for August, 1912, p. 411.

tion, by the removal of portions of the sides, will be given if necessary for the free entry and circulation of the gas. The risk of any consequent damage must be borne by the consignee.

A fee of 6*d.* per package will be charged for fumigation when the invoiced weight of the contents is 100 lb. or less, and 1*s.* when over 100 lb. A further fee of 2*d.* per package will be charged if additional ventilation has to be provided or packing removed It is recommended that boxes used as containers should be open for at least ½ in. along the angles of opposite sides and that packing should not be used.

Importation of Animals into the Sudan.—An Ordinance, dated February 20th, 1913, provides that cattle, sheep, goats, horses, mules, donkeys, and dogs imported into the Sudan *viâ* the Egyptian frontier or the Red Sea shall enter only through Halfa Town, Port Sudan, or Suakin. Animals of the kinds specified which are subject to quarantine must, on importation, be taken direct to the nearest quarantine station.

Importation of Raw Hides—The Ordinance further provides that raw hides and any other raw animal products to be specified by the Governor-General, if imported into the Sudan *viâ* Halfa Province or the Red Sea, must pass through Halfa Town, Port Sudan, or Suakin. They will be subject to an inspection by the Veterinary Officer, who may prohibit their importation, detain them temporarily, or have them disinfected (*Board of Trade Journal,* July 10th, 1913.)

Importation of Sheep and Goats into the Federated Malay States.—*The Federated Malay States Government Gazette* of June 20th contains a notification to the effect that Port Swettenham has been prescribed by the Resident of Selangor to be the only port through which sheep and goats may be imported into the State of Selangor from places outside the Federated Malay States. (*Board of Trade Journal,* July 24th, 1913)

Notes on Agriculture Abroad.

Cost of Rearing Horses in the United States.—In December, 1912, the Bureau of Statistics of the United States Department of Agriculture sent inquiries to about 30,000 correspondents, asking for data concerning the cost of rearing, on a farm, a horse until it reached the age of three years. The following instructions were given:—"In estimating the different items of cost in terms of money, the amount should be such as you would charge a neighbour, or a neighbour would charge you, for such service. Let the figures given represent your estimate of cost under normal conditions of recent years"

The results obtained by this inquiry were tabulated, showing the average cost of the different items for each State, the averages for the whole country being as follows:—

—	First Year	Second Year	Third Year	Total.
	£ s d	£ s. d	£ s. d	£ s d
Service fee of mare	—	—	—	2 14 0
Value of time lost by mare	—	—	—	2 1 11
Breaking	—	—	—	0 9 3
Veterinary	—	—	—	0 8 6
Care and shelter	1 0 9	1 2 4	1 6 5	3 9 6
Feeding	2 9 10	4 1 6	5 3 3	11 14 7
Other items ...	—	—	—	0 15 10
		Total	Expenses	£21 13 7

The receipts consist of the value of the work done by the horse, £1 11s. 4d., and the selling price of the animal at the end of the three years, £28 7s. 5d. The total receipts are thus £29 18s. 9d., giving an average profit of £8 5s. per horse over three years. (*U.S. Crop Reporter*, April, 1913.)

International Trials of Ploughing Machinery in Belgium.—International trials for steam and motor tractors and other ploughing engines will be held on a Belgian farm of over 4,000 acres from September 23rd to 27th next, the last day for entries being September 1st. The object in view is the introduction of this type of cultivation into the Belgian Congo, and the most suitable engine will be bought by the Colony or will receive a sum of money to cover partially the expenses of participation in the trials. The sum to be expended amounts to about £3,600. Particulars may be had on application to the Director-General of Agriculture, Ministry for the Belgian Colonies, 7, rue Thérésienne, Brussels.

The Weather in England during July.

District	Temperature		Rainfall			Bright Sunshine	
	Daily Mean	Diff from Average	Amount	Diff from Average	Number of Days with Rain	Daily Mean	Diff from Average
Week ending July 5th	°		Inches	Inches		Hours	Hours
England, N E	56 9	- 1 7	0 20	- 0 26	3	3 2	- 3 5
England, E ..	56 5	- 4 0	0 25	- 0 17	3	2 6	- 4 8
Midland Counties	59 8	- 0 1	0 12	- 0 35	2	4 1	- 2 6
England, S E	60 3	- 0 7	0 22	- 0 18	3	5 1	- 2 5
England, N W ..	58 5	- 0 2	0 15	- 0 43	2	6 2	- 2 2
England, S W	60 7	+ 1 3	0 05	- 0 48	1	7 8	+ 0 8
English Channel	60 4	- 0 2	0 04	- 0 41	2	7 8	- 0 7
Week ending July 12th							
England, N E .	54 3	- 4 5	0 22	- 0 26	3	4 7	- 1 8
England, E	55 7	- 5 0	0 19	- 0 33	3	5 0	- 2 1
Midland Counties .	55 6	- 4·5	0 47	- 0 03	3	2 4	- 3 9
England, S E	56 7	- 4 8	0 49	+ 0 02	4	4 2	- 3 1
England, N W	55 0	- 3 9	0 83	+ 0 20	4	3 8	- 2 4
England, S W	56 3	- 3 5	0 25	- 0 39	3	4 1	- 2 5
English Channel	57 4	- 3 8	0 32	- 0 20	3	4 4	- 3 7
Week ending July 19th							
England, N E	59 6	+ 0 9	0 17	- 0 37	2	2 3	- 4 0
England, E	60 3	- 0 4	0 99	+ 0 40	5	2 2	- 4 5
Midland Counties	59 8	- 0 3	0 17	- 0 41	4	1 7	- 4 1
England, S E	59 8	- 1·8	0 78	+ 0 23	4	1 9	- 4 9
England, N W	58 1	- 0 9	0 31	- 0 41	4	4 3	- 1 3
England, S W	59 2	- 0 8	0 19	- 0 56	3	3 8	- 2 4
English Channel	60 1	- 1 4	0 02	- 0 55	2	4 5	- 3 0
Week ending July 26th							
England, N E.	54 5	- 4·2	0·13	- 0 53	2	2 8	- 2 8
England, E	56 2	- 4 5	0 42	- 0 15	3	4 0	- 2 3
Midland Counties	57 2	- 2 8	0·09	- 0 53	1	4 8	- 0 7
England, S. E ...	58 4	- 3 2	0 05	- 0 51	1	5 8	- 0 7
England, N W	57 3	- 1 7	0 23	- 0 55	2	7·6	+ 2 2
England, S.W.	59 4	- 0 6	0·07	- 0·69	1	9 4	+ 3 5
English Channel	60·2	- 1·4	0·01	- 0·55	1	9·9	+ 2 5

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for July, 1913, issued by the International Institute, gives the condition of the crops in *Germany* on July 1st:—Winter wheat, 2·5; spring wheat, 2·7; winter and spring rye, 2·6; spring barley, 2·4; oats, 2·8 (1 = excellent, 2 = good, 3 = average, 4 = bad, 5 = very bad). In *Austria* the condition expressed according to the same system of notation was:—Wheat, 2·3; rye, 2·5; barley, 2·3; oats, 2·5; maize, 3·0. In *Hungary* an average yield of wheat and a good yield of rye is expected, but the growth of oats was completely arrested after the rains in the middle of the month, weeds invading the crops, which were already suffering from insect pests. The condition of winter cereals in *Croatia-Slavonia* is satisfactory, while spring crops show signs of giving a yield below the average, the forecasts for winter cereals being.—Wheat, 1,492,000 qr.; rye and meslin, 414,000 qr.; barley, 315,000 qr. The condition of all cereal crops in *Belgium* and *France* on July 1st was good, with the exception of maize in France, which was only fairly good. In *Bulgaria* weather conditions were excellent, and the state of the crops according to the system of notation in the country is represented by 5 = very good, for wheat, rye, barley, and maize, and by 4 = good, for oats. In *Italy* the wheat harvest was finished at the end of June in a number of districts, and a good out-turn is everywhere expected. In the 81 governments of *Russia* for which information is to hand on the condition of crops on June 14th winter cereals were inferior in only four governments, or 5 per cent., and spring cereals in six governments, or 7 per cent only. In all the other governments the condition of winter and spring cereals was either average or above the average In *Canada* the weather during June was cold and dry. In Quebec, Ontario, and the Maritime Provinces rain is required. In the west, conditions generally are favourable, especially in Saskatchewan and Alberta.

Forecasts of Total Production.—For certain countries in the Northern Hemisphere the Institute gives estimates of the total production:—

Wheat—The countries for which the total production is estimated are Belgium, Bulgaria, Denmark, Spain, England and Wales, Hungary (proper), Italy, Luxemburg, Russia in Europe (63 governments), Switzerland, United States, India, and Japan. Together they are expected to produce 309,131,000 qr., as against 292,303,000 qr. in 1912, or an increase of 5·8 per cent. Russia and Italy show an increase of 20,622,000 qr. and 4,086,000 qr. respectively; while Hungary, the United States, and India have a decrease of 3,252,000 qr., 3,657,000 qr., and 1,525,000 qr. respectively.

Rye.—The forecasts relate to Belgium, Bulgaria, Denmark, Spain, Hungary (proper), Italy, Luxemburg, Prussia, Russia in Europe, and Switzerland, which are expected to produce 161,886,000 qr., against 173,602,000 qr. last year., *i.e.,* a reduction of 6·7 per cent. Russia is almost entirely responsible for this decrease, the falling off in production there being 10,161,000 qr., while in Prussia also production is lower by 1,803,000 qr.

Barley.—The same countries as those already given for wheat, excluding India, are together expected to contribute 124,961,000 qr. to the total world's production, against 121,430,000 qr. in 1912, represent-

ing an increase of 2·9 per cent. The United States is expected to produce 7,057,000 qr. less than last year, while the estimate for Russia in Europe shows a probable increase of 8,926,000 qr.

Oats.—The countries for which particulars are available are the same as for barley. They are expected to give a yield of 250,232,000 qr., against 278,925,000 qr. in 1912, or a decrease of 10·3 per cent. The United States is mainly responsible for this decrease, as the probable yield will be 39,716,000 qr. less than last year, whereas most of the other countries show a slight increase, which in the case of Russia in Europe amounts to 5,778,000 qr.

Crops in the Southern Hemisphere.—The sowing of winter crops in Chili is in full swing, and germination is regular. In New Zealand sowing is nearly finished, the germination of seeds already sown being irregular. In both countries the weather conditions are unfavourable.

Sugar Beet.—Provisional figures are available for the area under cultivation in 1913 for certain countries The areas are as follows:—Bulgaria, 8,645 acres; Denmark, 76,570 acres; Hungary (proper), 457,073 acres; Italy, 133,380 acres, these areas being larger than in 1912; Belgium, 129,475 acres; Spain, 70,395 acres; France, 571,657 acres, these areas being smaller than in 1912 In Austria the recent rains greatly benefited the sugar beets, which appear more regular than last month, although they need heat to continue their growth satisfactorily. The condition in Hungary (proper), Denmark, Spain, France, and Italy is good, and in Croatia-Slavonia and Bulgaria very good In Belgium sudden changes of temperature and rains have been unfavourable to the crop, and the appearance of aphides and the growth of weeds place the crop in a critical situation, the condition on July 1st being average.

France.—The Ministry of Agriculture have published in the *Journal Officiel* the following figures relating to the areas under the crops this year (in acres):—Wheat, 16,168,521, compared with 16,172,424 in 1912, barley, 1,866,283, compared with 1,868,382; oats, 9,876,295, compared with 9,891,757; rye, 2,945,228, compared with 2,996,826; and potatoes, 3,678,991, compared with 3,818,842. Maize occupies 1,019,369 acres, and hops 7,054.

Germany.—The weekly report of the German Agricultural Councils for August 2nd states that prospects are generally satisfactory and occasionally good. The fine weather which has at last set in in the west and south has revived hopes for medium to good crops, although the influence of the wet weather on the quality is expected to be marked. In east and central Germany and in Saxony rye harvesting was delayed by rain. In some instances drought is still complained of in Brandenburg, Pomerania, and Mecklenburg A good deal of winter rye is cut, but only a little secured. On good soils the yield and quality are medium to good, but on light soils the result is often poor, and the grain small. Winter wheat has improved, and is expected to be ripe in a week or two. In the north and east oats is the least satisfactory crop, but in the west and south its condition is generally excellent. Hay is frequently of poor quality, while the quantity is satisfactory to good. Reports on potatoes vary considerably. Late sorts have made progress, but early sorts often suffer from leaf curl,

and are giving a poor yield. On some heavy soils the tubers are rotting.

The yield of winter rye in Prussia is officially estimated at 38,341,000 qr., an increase of about 2 per cent. compared with that of last year. (*Statistische Korrespondenz,* July 10th.)

Hungary.—The official report of July 21st estimates the yield of wheat at 17,991,000 qr., compared with 21,660,000 qr., the final estimate of 1912; of rye at 5,852,000 qr., compared with 6,315,000 qr.; of barley at 8,880,000 qr., compared with 8,414,000 qr.; and of oats at 10,021,000 qr., compared with 7,872,000 qr. Owing to excessive rain maize has frequently turned yellow Present conditions indicate an average crop. Potatoes are also average. Early hops have ceased flowering, and promise a good crop, but the later varieties have suffered somewhat from unfavourable weather.

Italy.—The official report for the second ten days of July stated that in the southern Mediterranean region vegetation had made satisfactory progress, but, although light showers had proved beneficial over the greater part of the country, yet in places rain was required The grain crop was considerably better than the average. Maize promised a good yield. Threshing results were satisfactory in Sicily. (*Dornbusch,* August 7th.)

Holland.—The Dutch Ministry of Agriculture gives the area under the principal crops this year as follows:—(In acres) Wheat, 139,802, compared with 142,899 in 1912; barley, 66,354, compared with 65,902; rye, 562,078, compared with 563,269; oats, 342,169, compared with 340,522; beans and peas, 126,420, compared with 122,082; edible potatoes, 337,755 compared with 351,333; factory potatoes, 77,244, compared with 74,357; sugar beet, 149,571, compared with 160,115; onions, 6,541, compared with 7,289; and red clover, 70,647, compared with 59,732. On July 12th wheat was generally in good condition except in Zeeland and South Holland. On the whole, rye had not developed sufficiently, and prospects were from moderate to good. In most parts of the country the prospects of winter barley left much to be desired, but, contrary to last year, an abundant crop of oats was expected. Beans and peas had suffered from unfavourable weather, and had a bad appearance. During the previous few weeks edible potatoes had made but little progress; otherwise, however, they were satisfactory, little disease having appeared. Factory potatoes were less satisfactory, and it was expected that only half or two-thirds of last year's yield would be obtained. The crop of 1912, however, was exceptionally large. The condition of onions was fairly good throughout the country. (H.M. Consul at Rotterdam.)

Russia.—The official *Commercial Gazette* of St. Petersburg of August 2nd states, from information received from the Minister of Commerce, that there have been, in general, but slight changes in the condition of the crops during the last fortnight, although in some districts bad weather has unfavourably affected the quality of the grain, hindering field work and threatening a falling off in the yield. On the whole both winter and spring grains are satisfactory or good, but in the Caucasus the condition of maize is often bad. (*H.M. Commercial Attaché at St. Petersburg.*)

Canada.—A bulletin issued on July 25th by the Census and Statistics

Office at Ottawa gives the finally revised estimates of the areas under cereals as follows.—Wheat, 9,816,300 acres, an increase of 57,900 acres compared with 1912; oats, 9,646,000 acres, an increase of 429,500 acres; rye, 127,200 acres, a decrease of 8,910 acres; and barley, 1,430,800 acres, an increase of 15,600 acres. The area under maize for husking is provisionally estimated at 290,000 acres, under potatoes at 467,800 acres, and under sugar beet at 19,250 acres. Potatoes occupy a larger area than last year, but maize a smaller. On June 30th the condition of winter wheat, 100 representing the promise of a full crop, was 81.46, spring wheat 87.80, oats 87.71, barley 88.39, and rye 85.95.

United States.—The Department of Agriculture gives the following estimates of the yield of the cereals as indicated by their condition on August 1st (in bushels):—Winter wheat, 511,000,000, compared with 399,919,000, the final figures of 1912, spring wheat, 233,000,000, compared with 330,348,000; oats, 1,028,000,000, compared with 1,418,337,000; barley, 168,000,000, compared with 223,824,000; maize, 2,672,000,000, compared with 3,124,746,000; and rye, 35,000,000, compared with 35,664,000. The proportion of last year's oat crop in farmers' hands on August 1st was about 7.3 per cent., or 103,900,000 bushels. On August 1st, 1912, the proportion was about 3.8 per cent., or 34,872,000 bushels. (*Dornbusch,* August 8th.)

Hops.—Messrs. John Barth and Sons, in a report dated July 26th, state that the prospects for the 1913 world's hop crop were still fairly satisfactory at that date. The great difference between day and night temperatures towards the middle of May favoured the attacks of vermin in all the European hop-growing districts. Plentiful rains and artificial washing, however, had stopped the further increase of the vermin in nearly all countries, but the crops were still endangered. It may be said that Austria-Hungary will hardly produce more than half of last year's yield. The area under cultivation throughout the world is estimated to be about 10,000 acres larger than last year.

Austria.—According to the official report on the condition of hops at the end of July, with favourable weather a good average yield is expected in Upper Austria. Some gardens have suffered from vermin, but frequent washings have generally been successful. In east Styria the crop will be a good average one, but in the south of that province it will not be more than half of that of last year. Damage by vermin has been considerable in Bohemia, and the yield promises to be about average in the Auscha district, below average in the Dauba district, while in the Saaz district only one-third of last year's crop will be obtained. In Moravia most gardens are free from vermin, but the yield will be considerably less than that of last year. No reports were received from Galicia.

Live Stock in Canada.—The numbers of live stock on June 30th compared with those at the same date last year are estimated as follows:—Horses, 2,535,000, an increase of 8·5 per cent.; milk cows, 3,064,900, an increase of 6 per cent.; other cattle, 3,380,400, a decrease of 17·4 per cent.; sheep, 2,418,400, an increase of 2·4 per cent.; and pigs, 3,254,400, an increase of 22.5 per cent. (*Bulletin of Agricultural Statistics,* July, 1913.)

The following extracts from reports received from H.M. Consuls show the condition and prospects of the fruit and potato crops in certain parts of Germany, France, and Belgium:—

Fruit and Potato Crops Abroad.

Germany. — *Brandenburg, Province of Saxony, and Silesia (July 8th).*—On the average there may be expected in this district a moderate crop of plums. The principal varieties grown in the district are Victorias, Wangenheimer, and Buhler Early Zwetschen, Hauszwetchen Mirabelles, and greengages for dessert, chiefly Hauszwetschen for cooking, and Mirabellen von Nanzy, large greengages and Italian Zwetschen for jam-making. The varieties mainly used for home consumption are Victorias, Wangenheimer, and Buhler Early Zwetschen, Hauszwetschen, Oulin greengages, and large greengages. The principal kinds exported are blue Hauszwetschen, large greengages, and Mirabellen von Nanzy.

The Zwetschen crop this year is expected to be very fair in Brandenburg—in some parts, especially the Altmark district, very good. In the Province of Saxony they will be moderately good, and very fair in Silesia. The prices of this crop should be very nearly the same as last year, perhaps, on an average, 1*s.* per cwt. higher. The early kinds of Hauszwetschen are expected to realise 10*s.* to 18*s.* per cwt., the later varieties 4*s.* to 8*s.* per cwt., and Mirabellen von Nanzy, 15*s.* per cwt.

France.—*Bordeaux Consular District (July 25th).*—The prospects of the coming plum crop in this district are not over-hopeful. Although blossom was plentiful, yet the persistent cold and wet weather which occurred during April and part of May resulted in the non-formation of the stones and a very heavy fall of fruit. At present the crop is estimated at about the same as last year, viz., 200,000 cwt., but this estimate is only approximate, depending on the size of the fruit

Subject to favourable weather until the nuts have reached maturity (about October), Marbat walnuts are expected to give a very moderate crop—about three-fourths of that of 1912. The Carnes variety is expected to yield a good medium crop, better than that of last year, but smaller than that of 1911; while Lats will be a short crop. Short supplies of Grenoble walnuts are anticipated.

If good weather continues to the end of July there is every reason to expect a good yield of potatoes. In most parts of the district the crop is expected to be much better than that of 1912, which suffered to a great extent from a wet season. The tubers are somewhat small in size, but up to the present no disease has appeared. Digging has been nearly completed in the Gironde Department, but in the other Departments, such as Charente-Inferieure, Vendée, &c., it will not begin for about a week.

Belgium.—*Bruges Vice-Consular District (July 24th).*—Plums will only yield half a crop. It is impossible as yet to fix their approximate prices, but these will certainly run high. A poor yield of greengages is expected, and prices will be high, probably not less than about 4½*d.* per lb. Nuts will be an average crop. Apples will yield abundantly, and prices will, in all probability, be lower than last year, ranging from 6*s.* to 8*s.* per cwt. Pears are a good crop, and prices will also be lower than last year, varying from about 1¼*d.* to 1½*d.* per lb.

Agricultural Conditions in England and Wales on August 1st.

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on August 1st, state that the weather of July, while very favourable for making and harvesting hay, proved too dry for most of the crops. Some districts did indeed benefit from occasional rains, but these were generally insufficient, and in most districts the absence of rain had a detrimental effect upon all the crops. The corn harvest had commenced in some of the earliest districts before the end of July.

The wheat crop has in some counties improved during the month and matured well, but in others it has deteriorated; taking the country as a whole, the probable yield of the crop is expected to be 2 per cent. under the average, being precisely the same figure as estimated a month ago. The condition and prospects of barley have shown a very slight deterioration on the month; but the expected yield is again put at about 7 per cent. under average. The absence of rain has told considerably against oats. In most parts of the country winter-sown crops are much more satisfactory than spring-sown, but the latter are as a rule very bad, and the crop generally is very thin and short in the straw. The yield is expected to be about 12 per cent. less than usual. For both barley and oats extremely poor crops are reported from the midland area of England.

Beans are not so satisfactory as a month ago. They are frequently stated to be podding well, but attacks of aphis have injured the crop in many places. Peas have suffered from the dry weather, and now promise only a poor yield.

The potato crop is healthy and growing fairly well, but needs rain to swell the tubers. Early varieties have been lifting rather lightly. Estimates of the probable yield have slightly improved in a number of districts, including Lancashire and Cheshire, but are slightly less favourable in others, including Yorkshire; on balance there is a slight reduction, but this is insufficient to affect the numerical estimate, and the yield is still indicated as 4 per cent. under average.

The dry weather has proved more harmful to the roots than to any other crops. Mangolds are thin and backward; in very few counties has the crop improved during July, and in many other counties it is much less promising than a month ago. For the country as a whole, the probable yield is estimated on present appearances as 10 per cent. below average, but in the west Midlands and south-west conditions are much more unfavourable.

In districts where timely rains fell sowings of turnips and swedes made a fair start, but in many cases the seed sown has failed to germinate, and often the hard state of the soil prevented the sowing of many acres intended for the crop. Where up, the crop is often very thin and backward. The prospects of all roots are therefore very unfavourable, and rain is badly needed to save them.

The hay crop affords a satisfactory feature in a lean season. The harvest proceeded rapidly in most counties, though delays occurred in some instances, and the amount of extra labour required was less than usual. The yield of the crops was fully equal to expectations, and in the case of meadow hay, exceeded them.

Hops have suffered from unusually persistent attacks of aphis which

have required continual washings to keep in check, and at the end of July the gardens were not free. Cold nights have checked the development of the burr, and consequently the estimates show a considerable reduction in all districts. Conditions are still much better in Kent than elsewhere, but the general yield is now expected to be only seven-eighths of an average crop.

The outlook for orchard fruit is less favourable than last month. The absence of moisture has caused fruit to drop in some districts, and frequently trees are also blighted. Apples are likely to give a small crop, while plums and pears will be very short in most districts.

Pastures have in most counties become bare, and rain is much needed for them. All classes of live stock have done well, as a rule.

The favourable weather for the hay harvest and the poor condition of the root crops shortened the demand for temporary labourers, but from most parts of the country reports are made of more or less serious shortage of labour.

Summarising the returns, and expressing an average crop by 100, the condition of the crops on August 1st indicated probable yields which may be denoted by the following percentages:—Wheat, 98; barley, 93; oats, 88; beans, 97; peas, 94; potatoes, 96; mangolds, 90; seeds hay, 108; meadow hay, 104; hops, 87.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on August 1st, 1913, certain disease of animals existed in the countries specified:—

Austria (for the period July 16th—23rd).
Anthrax, Blackleg, Foot-and-Mouth Disease (total of 332 Hofe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period May 16th—31st).
Anthrax, Blackleg, Foot-and-Mouth Disease (39 outbreaks in 15 communes), Glanders and Farcy, Rabies

Bulgaria (for the period June 14th—21st)
Glanders and Farcy, Rabies, Sheep-pox.

Denmark (month of June).
Anthrax, Glanders and Farcy, Swine Erysipelas, Swine Fever.

France (for the period July 13th—19th).
Anthrax, Blackleg, Foot-and-Mouth Disease (1,997 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period June 15th—30th).
Foot-and-Mouth Disease (14 infected places in 9 parishes), Glanders and Farcy, Swine Fever.

Holland (month of June).
Anthrax, Foot-and-Mouth Disease (1 outbreak in 1 province), Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (for the period July 9th—16th).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 107 "cours"

now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period July 7th—13th).

Anthrax, Blackleg, Foot-and-Mouth Disease (3,722 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period March 1st—15th).

Nil (no later returns received)

Norway (month of June).

Anthrax, Blackleg, Swine Fever.

Rumania (for the period June 21st—29th).

Anthrax, Dourine, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of March).

Anthrax, Foot-and-Mouth Disease (1,495 animals in 54 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever

Servia (no further returns received).

Spain (month of May).

Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (1,841 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis

Sweden (month of June).

Anthrax, Blackleg, Swine Erysipelas, Swine Fever

Switzerland (for the period July 14th—20th)

Anthrax, Blackleg, Foot-and-Mouth Disease (176 "étables" and Alpine-Pâturages entailing 5,624 animals, of which 51 "étables" and Alpine-Pâturages were declared infected during the period), Swine Fever

Agricultural Labour in England during July.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in July

According to the returns received farm work generally proceeded without interruption from wet weather during July, only a few correspondents, chiefly in *Kent* and *Sussex,* mentioning any loss of time from this cause. In most districts the hay harvest and hoeing provided a good deal of work for extra labourers (men outside the regular farm staff), but in some parts, more particularly in the south, the demand for such men was reduced on account of the backward condition of the root crops.

Reports of an insufficient supply of extra labourers came from one or more districts in practically every county. The scarcity appeared to be most marked in the northern counties, and in *Cheshire, Leicestershire, Shropshire, Hertfordshire, Cambridgeshire, Lincolnshire, Kent, Sussex, Devonshire,* and *Cornwall* A deficiency of men for permanent situations was also reported from a number of districts, particularly in *Kent, Devonshire,* and *Cornwall.*

THE CORN MARKETS IN JULY.

C. KAINS-JACKSON.

British Wheat.—Farmers' deliveries in July were small, and, speaking broadly, it may be said that the month has seen the farmer supplying but 5 per cent. of the contents of the loaf. As the miller supplies the baker with a mixture averaging 20 per cent. of British flour, much buying forward and storing is required. The price made for the scanty deliveries of 1912 corn has shown a slight advance on the month, and there have been averages of over 36*s.* recorded at Mark Lane, Canterbury, and a few other markets. The dry weather of June favoured threshings, and the wheat which has come on sale in July has been fit and hard. The want of sunshine during the month reduced the rate of crop ripening, and by the 31st it had become clear that instead of the early harvest expected at the end of May, even a very fine August could not bring harvest earlier than an average date. The consequent need for old wheat up to the very end of the cereal year strengthened the position of farmers who still had some to sell.

Colonial and Indian Wheat.—Canada shipped freely all through the month, and the different grades were obtainable just before the Bank Holiday at 6*d.* decline, the first grade being offered at 39*s.* 6*d.* No. 4 at 35*s.* was a good wheat. Indian wheat came to hand in good quantity during July, and there was an excellent choice. Quality seems rather above the average this season, whether the wheat is from Calcutta, Bombay (and Delhi *viâ* Bombay) or Karachi. On the 30th, fine Indian wheat could be bought at Mark Lane at 38*s.* for white, and 37*s.* 9*d.* for red, weight being 492 lb. The red is no longer separated from the white by a shilling in selling value as formerly. Some very big cargoes of Australasian wheat came to hand during July, and temporarily depressed the market, but white wheat of medium strength seemed to be in continued request. Little or no New Zealand wheat is now to be had at any British port.

Foreign Wheat.—The United States have continued to sell new winter wheat with remarkable steadiness at 35*s.* 3*d.* per 480 lb. free to Tilbury. This has given Mark Lane a basic price of 36*s.* off stands. The new crop of spring wheat is held very firmly; in fact, July closed without any offers to ship it. America, therefore, was a very steadying influence all through July. Argentina accepted 37*s.* 6*d.* to 38*s.* for fair average quality wheat, and Russia took 34*s.* for common red, 35*s* for Odessa Ghirka, and 36*s.* for fine winter sorts. Wheat from S.E. Europe has for the time being disappeared from British markets.

Supplies and Shipments.—Imports, which would have been excessive in later autumn when farmers' deliveries are large, were no more than about enough to meet current requirements in July. Shipments from North America reached 1,519,000 qr., the largest July total for a good many years. Neither the United States nor Canada shipped very heavily, but both shipped above the average. Argentina's shipments dropped to 330,000 qr., and those of Australasia did not exceed 237,000 qr. India managed to send from her two coasts 1,258,000 qr. of the new crop, while Russia shipped only

718,000 qr., against 1,041,000, 2,176,000, and 2,130,000 qr. for the same month in the three preceding years. As millers can mostly use Indian wheat when Russian fails them, little inconvenience will be felt. The shipments of S.E. Europe have naturally been very small, and have not included anything from the United Kingdom. On the last day of the month there were 2,700,000 qr. of wheat on passage to our ports. This showed 700,000 qr. decline from June 30th.

Flour.—London makes were maintained in value for four weeks, but declined 6*d.* per sack just before the close of the month; the final quotations, cash ex-London mill, were:—Top Grade, 32*s.* 6*d.*; Town Whites, 31*s.*; Town Households, 28*s.*; and Secondary Households, 26*s.* 6*d.* Standard or Eighty-per-cent flour was quoted at the same price as Town Households. American and Canadian sorts of flour have ranged from 24*s.* for Secondary "Bakers" up to 30*s.* for the scarcer-named patents. The majority of transactions were put through at 25*s.* for First "Bakers," and 28*s.* for ordinary good patents. Country flour in July is not much in evidence, and prices were not changed. There were only 343,000 sacks shipped from North America, and only 174,000 sacks were on passage on the 31st. This prospective supply did not include any Californian, a somewhat rare absence.

Barley.—Both deliveries by farmers and imports by merchants have been much below the mean, but inquiry has likewise been very small, and price change has been hardly discernible. A few country markets have been a trifle dearer for English, while a few ports have made a slight concession in order to effect prompt sales of Indian There has been a fair sale of Russian and Persian on merit of sample, and reluctance to buy American and Canadian has been associated with want of merit. The shipments of the month were 45,000 qr. from North America, 20,000 qr. from South America, 235,000 qr from India, and 1,323,000 qr. from Russia. There were not quite 400,000 qr. on passage on the last day of the month, the Continent having purchased an unusually large proportion of the Russian shipments.

Oats.—British have ranged from 16*s.* in the Fen country to 23*s.* at markets where really fine quality could still be met with. The demand for fine old and heavy oats is expected to exceed the supply for some time to come. On the other hand, inferior and light oats have seldom if ever been pressed in greater quantity on an unwilling market. Canada, America, and Argentina all want to sell, and are ready to take very low prices—17*s.* to 19*s.* per qr To put good oats on the market, however, seems beyond their power, while Australia, New Zealand, and Sweden, whence fine 320-lb. oats used to arrive with same steadiness, have during the last few years given our market but feeble and irregular aid July shipments were 262,000 qr. from North America, 260,000 qr. from South America, 151,000 qr. from Russia, and 8,000 qr. from Germany. There are now 240,000 qr. on passage.

Maize.—The leading feature of this trade is that with the colossal quantity of 1,545,000 qr. on passage, prices are maintained. There is a very steady and equally distributed demand, and the national consumption of maize is thought by some to be at the rate of a million quarters per month. Even so, the stability of spot value is a little remarkable, for the imports of July were 25 per cent. above a million The dominant wholesale quotation remains 5*s.* per cental. Shipments

from Argentina were, in round numbers, 3,000,000 qr., and from all parts whence the round sort is derived 447,000 qr. Of flat maize from the U.S. and of white from South and East Africa there were practically no exports. Burma sent off 25,000 qr. of yellow grain.

Oilseeds.—It was pointed out a month ago that linseed at two guineas per quarter assumes a position in which an exceptionally large demand may be anticipated, a position in which those with oilcake to make for winter use and those interested in the production of oilcloth (a very large trade) may by competition quickly run up the price. During July this has, in fact, occurred, and value is up a full 3*s.* on the month, which closed with 45*s.* per qr. as about the lowest quotation. The quantity on passage was 220,000 qr. Cottonseed was the subject of a remarkable price advance for Egyptian, the leading type. There seems to have been a heavy under-estimating of the forward orders likely for August, September, and October delivery, and the new crop is not to be relied upon for delivery before November. Hence there was a rapid rise of quite a penny per cwt. daily for the last twelve trading days of the month. On the 31st, 10*s.* per cwt. was readily paid. Rapeseed has advanced 2*s.* per qr., in sympathy with the two chief oilseeds.

Various.—A decline in beet sugar, molasses, &c., has enabled the makers of various proprietary fattening foods to put them before stock owners at tempting prices. Articles on sale at lower prices than usual have been small pulse from India, sorghum from Argentina, and linseed cake from Russia. On the other hand, Canary seed was hardly obtainable under £5 per qr., and soy bean cake was 10*s.* per ton dearer than a year ago.

THE LIVE AND DEAD MEAT TRADE IN JULY.

A. T. MATTHEWS

Fat Cattle.—The grazing season has been very favourable up to the end of July, grass being plentiful and of good quality. It is well known that cattle always thrive faster in fine weather, for not only are they under comfortable conditions, but the grass is more nourishing. The result of these favourable conditions has been an early and good supply of cattle from the pastures, especially of Herefords from the Midland counties, such as Northampton and Leicester. The long-continued deficiency in the numbers at market has ceased, for the present at least, and the three years' average has recently been exceeded. It is true that butchers complain that the grass-fed animals do not weigh very well, but they compare favourably in this respect with the same class in most seasons. The fact that prices have been so nearly maintained in face of increased supplies points to a healthy demand and better profits than usual for the grazier, the only drawback being the high cost of stores to start with. The average prices of first quality Shorthorns in English and Welsh markets during July were 9*s.* 2*d.*, and 8*s.* 5*d.* for second quality, against 9*s.* 3*d.* and 8*s.* 6*d.* in June; Herefords, 9*s.* 7*d.* and 8*s.* 9*d.*, against 9*s.* 6*d.* and 8*s.* 9*d.*; Devons, 9*s.* 4*d.* and 8*s.* 5*d.*, against 9*s.* 5*d.* and 8*s.* 4*d.*; Polled Scots, 9*s.* 4*d.*

and 8*s*. 9*d*., against 9*s*. 6*d*. and 8*s*. 10*d*. It is early in the season for Welsh Runts, and comparatively few were offered; these averaged 9*s*. and 8*s*. 1*d*. for first and second quality respectively. Compared with the same period last year, prices are only about 2*d*. per stone lower. They were then considered exceptionally high.

Veal Calves.—There has been no excessive supply of fat calves, but averages are lower by ½*d*. per lb. than in June. Prices have been very steady at an average of 9*d*. and 8¼*d*. for first and second quality, which is ¾*d*. per lb. more than the prices of a year ago. Probably the good demand for calves for rearing has had some effect on the supplies.

Fat Sheep.—As regards supplies there was a considerable improvement in the third week, when the total for thirty-six English markets was larger by about 7 per cent. than the average of the preceding three years. As with cattle the causes may be found in the favourable season for conditioning the sheep and the remunerative prices obtainable. They have come to market well finished, and this should be taken into account when comparing prices per lb. with those of other seasons. Prices have been well maintained during July, and are singularly near the level of those ruling last year at corresponding date. Downs in about twenty-four markets averaged 8¾*d*, 8*d*. and 6½*d*. for first, second, and third qualities, against 8¾*d*., 8*d*., and 6¾*d* in June; Longwools, 8¼*d*, 7¼*d*., and 6*d*, against 8¼*d*, 7½*d*, and 6*d*.; prime Cheviots, 9¼*d*, against 9½*d*.; and prime Cross-breeds, 8¾*d*., against 8¾*d*. per lb.

Supplies at Islington have been small, and there was a noticeable absence of supplies of light weights from Scotland.

Fat Lambs.—Supplies have been ample, but, with a fair demand, prices, though ½*d*. per lb. lower than in June, have been very good for the time of year and the increased weight of the lambs In about thirty-four English markets the average was 10*d* per lb for first and 9*d*. for second quality.

Fat Pigs.—The value of bacon pigs rose steadily after the first week, and the month's prices were higher than those of June. In about twenty-one English markets the averages for first and second quality were 8*s*. 6*d*. and 8*s*. per 14-lb. stone respectively.

Carcass Beef.—*British*.—Scotch beef was again scantily supplied to the London market, and in the third week there were no whole sides at all on offer. For the first three weeks prices were very firm, but towards the end of the month the holidays curtailed the demand, and there was some decline. Scotch short sides averaged 5*s*. 1*d*. and 4*s*. 9*d*. per 8-lb stone; long sides, 4*s*. 8*d* and 4*s*. 6*d*.; and English, 4*s*. 7*d* and 4*s*. 5*d*. A small quantity of inferior Irish averaged 4*s*. 3*d*. and 4*s*. 1*d*. per stone.

Canadian Beef.—Some Canadian sides have been on offer at Smithfield each week, but scarcely any of good finish, though, perhaps, rather superior to the Irish. The average price was 4*s*. 5*d*. for first, and 4*s*. 3*d*. for second quality.

Chilled Beef.—The Argentine supplies have been moderate, but prices gradually dropped as the month went on, especially for hindquarters, although the weather was highly favourable for this class of beef, which is often seriously affected in value by sudden spells of high temperature. The average values in Smithfield market were 3*s*. 9*d*. and 3*s*. 5*d*. per stone for hinds and 2*s*. 3*d*. and 2*s*. 1*d*. for fores.

Frozen Beef.—"Hard" beef supplies, being controlled at the will of the holders, are less affected in price by weather changes than chilled beef. Values for New Zealand have stood all the month at 2*s.* 10*d.* and 2*s.* 8*d* for hinds, and 2*s.* 2*d.* and 2*s.* 1*d.* for fores. This is about 3*d.* per stone more for hindquarters than the June prices.

Carcass Mutton.—Fresh Killed.—Scotch mutton was in small supply, but varied in price each week. It never exceeded 5*s.* 8*d.* per stone for the best quality, and averaged 5*s.* 6*d.* and 5*s.* 2*d.* for first and second. English was in moderate request at 4*s.* 11*d.* and 4*s.* 8*d.* Dutch mutton was forward in fair quantities, and sold relatively well, owing to the cool weather. Its average value was 4*s.* 7*d.* and 4*s.* 3*d.* per stone.

Frozen Mutton.—The frozen mutton trade was quietly steady throughout. New Zealand averaged 3*s.* 1*d.* per stone for prime teg, and 2*s.* 8*d.* for heavy carcasses. Australian was very sparingly offered and Argentine made from 2*s.* 6*d.* to 2*s.* 10*d.*

Lamb.—Fresh Killed.—The London trade for British lamb was very slow, salesmen complaining of the very poor demand. After the first week, when the primest quality was only worth 6*s.* per stone, the price fell to 5*s.* 8*d.*, with second quality at 5*s.* 4*d.*, or 8*d* per lb.

Frozen Lamb.—New Zealand again almost monopolised the market for frozen lamb, but prices were much lower than in June, and average prices were 4*s.* 1*d.* and 3*s* 8*d.* per stone.

Veal.—Supplies were very irregular, and prices for best English fluctuated between 4*s.* 8*d.* and 5*s.* 4*d*, the averages being 5*s.* 2*d.* and 4*s* 8*d* for first and second quality Prime Dutch made a slightly higher price.

Pork—The small supplies coming to hand have been easily cleared at high prices for the time of year. British has ruled at 4*s.* 8*d.* to 5*s* 2*d*, and Dutch at 4*s.* 6*d* to 5*s.* per stone.

THE PROVISION TRADE IN JULY.

HEDLEY STEVENS

Bacon.—All dealers in hog products are passing through a trying experience on account of the exceptionally high prices and the consequent difficulty in making profits.

Best descriptions of long sides are commanding 10*s.* to 12*s.* per cwt. above last year's prices, and best Russian sides 15*s.* to 16*s* per cwt. more, as, in addition, quality of this kind of bacon has much improved. In American bacon and hams the advance is even more pronounced, some descriptions of hams realising 24*s.* per cwt. above prices current last year. These conditions have been brought about solely by short supplies, and it is not anticipated that there can be any appreciable increase in supplies until the autumn.

In America the demand keeps good and prices are high Prices of hogs at Chicago for the month have ranged from \$8.30 to \$9 60, against \$6.90 to \$8 35 last year, and \$6.10 to \$7.35 two years ago.

Arrivals from Canada continue very small, and some dealers have discontinued stocking this kind of imported bacon.

Home productions have participated in this advance, and curers of both English and Irish bacon complain that they cannot secure sufficient

pigs to fill their requirements, although willing to pay high prices for animals of the necessary weight.

Cheese.—Prices for most descriptions of cheese have steadily advanced throughout the month, contrary to the expectations of most dealers, as present prices of Canadian makes are unusually high for the month of July, and, it was anticipated, could not be maintained.

There is no doubt that these conditions have been partly brought about by speculation, but there appears to be a genuine shortage in the make of cheese in Canada, and the shipments to England from May 1st to July 18th of this year show a shortage of about 106,000 boxes compared with 1912, and about 173,000 boxes compared with 1911. This does not represent the shortage in make, as at the present time stocks stored in Montreal are larger than usual, and a considerable portion is said to have been bought by American dealers in anticipation of the reduction to three cents instead of six cents per lb. duty payable on Canadian cheese entering the United States. The receipts of cheese into Montreal from May 1st to July 17th were 568,585, against 646,257 for the same period of last year, showing a decrease of 77,672 cheeses.

The consumption has been fair but below the average, doubtless owing to high prices. Estimated stocks of Canadian cheese at the three principal distributing centres (London, Bristol, and Liverpool) at the end of the month were 209,000, against 226,000 at the same time last year, and 214,000 two years ago. Estimated stocks of New Zealand cheese in London and Bristol at the end of the month were 11,000 crates (two cheeses in each), against 8,700 last year.

As the New Zealand season for 1912 to 1913 is now practically at an end, it is interesting to note that we received from that Colony her record output of cheese, namely, 29,489 tons, the next largest amount being 24,993 tons For the same period (twelve months ending with June) we received from Canada 66,424 tons, or 6,266 less than in 1911-12. For the year ending June 30th, 1904 (nine years ago) we received 98,306 tons from Canada, and 4,110 tons from New Zealand.

Through the prevailing high prices of imported cheese there has been a large consumptive demand for English cheese at satisfactory prices On account of the dry weather in many cheese-making districts, the make during July is reported to be less, especially in the West of England.

Butter.—The demand for butter was quiet throughout the month, and on the whole prices favoured buyers.

There has been a large make of Siberian, which is now filling up the gap caused by the falling-off in arrivals from Australia, the season being practically over, and the quality of the late shipments mostly of a secondary character.

The new make of butter in Canada has been above that of last year, the receipts into Montreal from May 1st to July 17th being 209,329 packages, against 192,861 for the same period last year, or an increase of 16,468 packages. Prices continue above an export basis.

There has been a good trade passing in Irish butter, but prices are slightly easier on the month.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in July and June, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	July. First Quality.	July. Second Quality.	June. First Quality.	June. Second Quality.
FAT STOCK:—	per stone *	per stone *	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 4	8 9	9 6	8 10
Herefords …	9 7	8 9	9 6	8 9
Shorthorns	9 2	8 5	9 3	8 6
Devons	9 4	8 5	9 5	8 4
Welsh Runts …	9 0	8 1	9 4	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	9	8¼	9½	8¼
Sheep:—				
Downs	8¾	8	8¾	8
Longwools …	8¼	7¼	8¼	7½
Cheviots	9¼	8½	9½	8½
Blackfaced	8¼	8	8¾	8
Welsh …	—	7¾	9¼	8½
Cross-breds	8¾	7¾	8¾	7¾
	per stone *	per stone *	per stone *	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	8 6	8 0	8 3	7 9
Porkers	8 10	8 4	8 8	8 2
LEAN STOCK:—	per head	per head	per head	per head
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk	23 7	19 5	23 0	19 0
,, —Calvers	22 5	18 3	22 1	18 5
Other Breeds—In Milk	20 11	17 4	21 2	17 15
,, —Calvers	—	14 5	17 5	15 0
Calves for Rearing	2 14	2 1	2 14	2 2
Store Cattle:—				
Shorthorns—Yearlings …	11 0	9 13	11 15	10 3
,, —Two-year-olds	15 7	13 7	15 19	13 16
,, —Three-year-olds	18 19	16 11	20 12	17 15
Herefords—Two-year-olds	17 9	15 2	18 5	16 0
Devons— ,,	15 9	14 7	15 18	14 10
Welsh Runts— ,,	15 5	13 16	16 14	14 7
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools …	37 3	32 9	41 7	39 1
Store Pigs:—				
8 to 10 weeks old	26 4	21 8	26 9	21 1
12 to 16 weeks old	36 11	30 1	37 6	29 10

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in July, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.		Leeds.		Liverpool.		London.		Manchester	
		per cwt.		per cwt		per cwt		per cwt		per cwt	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF :—											
English	1st	61	0	61	0	59	6	64	0	60	0
	2nd	58	0	58	6	55	6	62	0	55	6
Cow and Bull	1st	53	6	55	0	51	0	49	0	52	6
	2nd	49	0	50	6	42	0	45	0	47	6
Irish: Port killed	1st	—		59	6	58	6	59	0	—	
	2nd	—		56	6	55	0	57	0	—	
Argentine Frozen—											
Hind Quarters	1st	39	6	39	0	38	6	38	6	38	6
Fore ,, ...	1st	31	0	30	6	30	6	29	6	30	6
Argentine Chilled—											
Hind Quarters	1st	51	0	51	0	50	0	52	6	50	0
Fore ,, ...	1st	31	6	30	6	30	0	31	6	30	0
Australian Frozen—											
Hind Quarters	1st	38	6	36	6	36	0	38	6	36	0
Fore ,, ...	1st	32	6	31	6	30	6	29	6	30	6
VEAL :—											
British	1st	—		71	0	80	0	72	6	78	6
	2nd	72	0	67	6	69	0	64	6	73	6
Foreign ...	1st	—		—		—		75	0	—	
MUTTON :—											
Scotch	1st	—		—		79	6	76	6	75	6
	2nd	—		—		74	6	72	0	71	0
English ...	1st	70	0	74	6	72	0	69	0	71	6
	2nd	63	6	70	6	65	6	65	0	66	6
Irish: Port killed ...	1st	—		—		72	0	—		—	
	2nd	—		—		65	0	—		—	
Argentine Frozen . .	1st	41	6	42	0	42	0	39	6	42	0
Australian ,, ...	1st	39	0	39	0	37	6	36	6	37	6
New Zealand ,, ...	1st	40	6	—		—		43	0	—	
LAMB :—											
British ..	1st	74	0	79	6	76	6	81	0	78	6
	2nd	69	6	74	6	66	6	75	6	73	6
New Zealand . .	1st	59	6	59	6	59	6	58	0	59	6
Australian	1st	56	6	—		55	0	—		55	0
Argentine ...	1st	54	6	—		54	0	—		54	0
PORK :—											
British	1st	72	0	70	0	72	6	69	0	74	6
	2nd	66	6	67	6	66	6	64	6	70	0
Foreign	1st	—		—		—		67	0	—	

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913

Weeks ended (*in* 1913).	WHEAT.			BARLEY.			OATS.		
	1911.	1912.	1913.	1911.	1912.	1913.	1911.	1912.	1913.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d*	*s. d.*	*s. d.*
Jan. 4 ...	30 5	33 2	30 5	23 11	33 3	28 6	17 0	20 7	19 10
,, 11 ...	30 8	33 1	30 3	23 10	33 0	28 4	17 2	20 8	19 2
,, 18	30 11	33 4	30 5	24 4	33 3	28 6	17 4	20 11	19 4
,, 25 ..	30 11	33 7	30 11	24 5	33 1	28 10	17 3	21 1	19 4
Feb. 1	30 9	33 8	31 1	24 5	32 10	28 11	17 5	21 3	20 2
,, 8	30 5	34 0	31 0	24 6	33 2	28 10	17 5	21 4	20 1
,, 15	30 3	34 4	30 9	24 7	32 10	29 1	17 6	21 7	20 2
,, 22	30 2	34 6	30 11	24 9	32 8	28 8	17 7	21 9	20 7
Mar. 1	30 0	34 1	31 0	25 0	32 0	28 6	17 5	21 6	20 4
,, 8 .	30 1	34 1	31 3	25 0	31 7	28 5	17 5	21 8	20 0
,, 15	30 1	34 0	31 1	24 11	31 2	27 11	17 6	21 8	20 2
,, 22	30 2	34 1	31 1	25 0	31 10	28 6	17 5	21 9	19 11
,, 29 .	30 3	34 4	31 3	24 11	30 3	27 6	17 5	21 8	19 7
Apl. 5	30 4	34 10	31 4	24 7	30 9	27 0	17 7	21 11	19 2
,, 12	30 3	35 4	31 3	25 2	30 2	27 8	18 3	22 1	19 2
,, 19	30 4	36 7	31 6	25 5	29 11	26 11	17 10	22 4	18 10
,, 26	30 11	37 10	31 8	25 5	30 4	26 7	18 3	22 9	19 3
May 3	31 4	38 1	32 2	25 7	30 2	25 11	18 6	23 1	19 6
,, 10 .	31 8	37 11	32 6	25 1	31 1	25 9	19 0	23 7	19 6
,, 17	32 6	37 8	32 10	25 4	31 2	25 4	19 2	23 7	19 9
,, 24 ..	32 8	37 2	32 10	25 0	31 1	25 3	19 5	23 7	19 11
,, 31 .	32 5	36 10	32 7	24 10	30 0	26 1	19 5	23 9	20 1
June 7 .	32 4	36 11	32 10	25 7	29 11	26 2	19 7	24 0	19 8
,, 14 .	32 3	37 0	32 8	23 11	30 8	24 7	19 8	23 10	20 2
,, 21	31 11	37 5	32 8	23 9	30 8	23 10	19 10	24 0	19 8
,, 28	31 10	37 10	32 8	24 5	30 2	24 3	19 9	23 11	19 1
July 5	32 1	38 2	33 1	25 10	31 7	25 2	19 9	23 11	21 0
,, 12	32 3	38 3	33 4	25 10	30 2	25 10	19 11	24 1	19 4
,, 19	32 5	38 10	33 6	24 3	30 9	24 9	19 5	24 8	20 5
,, 26	32 5	38 9	33 10	23 8	30 9	24 1	19 7	23 4	20 8
Aug 2	32 0	38 4	34 1	24 4	28 6	24 5	18 2	22 2	20 3
,, 9	31 6	39 2	34 1	26 9	30 7	24 9	18 0	22 4	19 0
,, 16	31 6	38 2		27 8	28 3		17 10	21 8	
,, 23	31 8	35 6		28 10	28 1		18 0	20 10	
,, 30	31 7	34 10		28 4	28 6		18 3	20 8	
Sept 6	31 10	35 1		28 4	29 9		18 1	21 8	
,, 13	32 0	33 5		29 0	29 0		18 5	20 5	
,, 20	32 4	32 7		29 11	29 6		18 9	19 10	
,, 27	32 6	31 7		30 5	29 9		19 1	19 5	
Oct 4	32 7	31 8		30 9	29 7		19 5	19 8	
,, 11	32 9	31 10		31 0	30 4		19 10	19 5	
,, 18 ..	32 9	32 2		31 5	30 11		19 11	19 9	
,, 25	33 1	33 1		31 7	31 6		20 6	19 10	
Nov 1 ..	33 4	33 4		31 10	31 10		20 8	20 1	
,, 8	33 4	33 1		32 7	31 11		20 11	19 11	
,, 15 ...	33 1	32 10		32 10	31 2		21 0	19 9	
,, 22	33 0	32 1		33 5	30 11		20 10	19 11	
,, 29	32 10	31 9		33 10	30 8		20 11	19 8	
Dec. 6 ...	32 9	31 0		34 0	29 11		20 9	19 6	
,, 13 ..	32 11	30 8		33 5	29 2		20 9	19 3	
,, 20 ..	32 9	30 7		33 5	28 11		20 8	19 1	
,, 27 ...	33 0	29 10		33 4	28 6		20 7	19 2	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1912.	1913.	1912.	1913.	1912.	1913.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	June	54 5	48 10	31 2	29 11	24 11	23 9
	July	54 4	48 4	31 3	29 9	24 11	23 8
Paris:	June	56 1	49 11	29 11	30 8	25 5	23 5
	July	56 9	50 2	30 6	30 8	25 0	24 11
Belgium:	May	39 4	36 1	31 9	29 8	27 0	23 2
	June	39 4	36 4	31 0	28 10	26 9	22 8
Berlin:	May	49 6	44 8	—	—	28 0	22 11
	June	49 8	43 10	—	—	26 9	22 3
Breslau:	May	44 10	39 2	—*	26 8*	26 4	21 0
				31 11†	25 3†		
	June	45 5	38 9	—*	—*	25 4	20 4
				31 10†	25 2†		

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of July, 1912 and 1913.

—	Wheat.		Barley.		Oats.	
	1912	1913.	1912.	1913.	1912.	1913.
	s. d.	s. d.	s. d.	s. d	s. d.	s. d.
London... . ..	39 11	35 9	—	26 1	24 5	20 8
Norwich	38 3	34 0	28 7	25 5	24 2	20 5
Peterborough	38 6	31 1	—	—	23 9	16 4
Lincoln...	38 1	32 2	29 11	25 11	—	20 5
Doncaster ..	37 8	31 9	—	—	23 10	18 10
Salisbury ..	38 5	32 4	—	—	24 7	19 9

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in July, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description	Bristol. First Quality.	Bristol. Second Quality.	Liverpool. First Quality.	Liverpool. Second Quality.	London. First Quality.	London. Second Quality
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb	per 12 lb.	per 12 lb	per 12 lb.	per 12 lb.	per 12 lb.
British ..	14 0	13 0	—	—	13 0	11 9
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	113 6	110 0	109 0	106 6	113 0	111 0
,, Factory	102 0	96 0	101 6	95 6	105 0	101 0
Danish .	—	—	123 0	120 0	122 0	120 0
French	—	—	—	—	113 6	107 6
Russian	104 0	99 6	104 0	100 0	100 0	97 6
Australian ...	110 0	105 0	—	—	109 0	107 0
New Zealand	118 0	116 0	—	—	116 0	114 0
Argentine	—	—	—	—	—	—
CHEESE :—						
British—						
Cheddar .	73 6	63 0	73 0	70 0	70 6	66 0
			120 lb	120 lb.	120 lb.	120 lb
Cheshire .	—	—	65 6	61 6	70 0	63 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian .. .	65 0	63 0	64 6	62 6	64 6	63 6
BACON :—						
Irish (Green)	86 0	81 0	85 6	79 6	88 0	84 6
Canadian (Green sides)	79 0	76 0	78 0	74 6	79 0	76 0
HAMS :—						
Cumberland (Dried or Smoked)	—	—	—	—	121 6	116 0
Irish (Dried or Smoked)	—	—	—	—	118 6	112 6
American (Green) (long cut)	88 0	86 0	86 0	84 0	90 0	87 6
EGGS :—	per 120.	per 120	per 120.	per 120.	per 120.	per 120.
British . ..	—	—	—	—	11 3	10 2
Irish	10 7	9 9	10 5	9 5	10 10	9 5
Danish .	—	—	—	—	10 10	9 5
POTATOES :—	per ton	per ton.	per ton.	per ton.	per ton	per ton.
Duke of York	150 0	115 0	110 0	100 0	123 6	110 0
Other First Earlies	180 0	151 6	131 6	123 6	131 6	111 6
British Queen ..	100 0	95 0	155 0	145 0	118 6	101 6
HAY :—						
Clover . . .	—	—	102 6	80 0	118 0	102 0
Meadow	—	—	—	—	100 6	84 6

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	JULY.		SEVEN MONTHS ENDED JULY	
	1913	1912.	1913.	1912.
Anthrax :—				
Outbreaks	28	32	345	529
Animals attacked	36	44	378	601
Foot-and-Mouth Disease —				
Outbreaks ..	—	51	—	55
Animals attacked	—	283	—	321
Glanders (including Farcy) —				
Outbreaks	14	19	100	106
Animals attacked	33	24	277	209
Parasitic Mange .—				
Outbreaks	130	133	1,794	2,233
Animals attacked	299	250	3,678	4,907
Sheep-Scab :—				
Outbreaks	3	3	124	165
Swine-Fever :—				
Outbreaks	244	230	1,474	2,027
Swine Slaughtered as diseased or exposed to infection	2,682	3,150	19,719	25,991
Tuberculosis ·—				
Number of Premises notified	493	—	*1,580	—
Number of bovine animals notified as for slaughter	529	—	*1,738	—

* Since 1st May, when the Tuberculosis Order came into operation

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	JULY		SEVEN MONTHS ENDED JULY.	
	1913	1912	1913	1912.
Anthrax :—				
Outbreaks ...	—	—	—	2
Animals attacked	—	—	—	2
Foot-and-Mouth Disease :—				
Outbreaks	—	16	—	16
Animals attacked	—	198	—	198
Glanders (including Farcy) —				
Outbreaks ..	—	—	—	—
Animals attacked	—	—		—
Parasitic Mange :—				
Outbreaks	1	3	93	48
Sheep-Scab —				
Outbreaks	32	5	351	262
Swine-Fever :—				
Outbreaks	12	20	97	157
Swine Slaughtered as diseased or exposed to infection ...	64	114	567	1,389

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TUBERCULOSIS IN FARM STOCK.*

TUBERCULOSIS is a contagious disease caused by a particular species of micro-organism called the tubercle bacillus.

It is to be noted that the disease is contagious. Tuberculosis has a very wide distribution, and affects man and many different species of mammals and birds. The prevalence of tuberculosis amongst cattle is very great, particularly amongst dairy cows. Probably not less than 25 per cent. of adult indoor cattle in this country are affected. Swine also are frequently attacked, and in them the disease is often of bovine origin; that is to say, they become infected through eating the diseased organs of tuberculous cattle or through being fed upon whole or skimmed milk from cows with tuberculous udders.

Of the other domesticated mammals, horses, cats, and dogs are susceptible to tuberculosis, but very few cases have been recorded as occurring in sheep and goats.

The bacilli on gaining entrance to the body may become established in various positions and multiply there, causing alterations in the cells and destruction of tissue. In this way the characteristic nodules or tubercles are formed, and consequent upon their formation there is interference with the function of the part or organ. In addition to causing local effects, products of the bacilli are absorbed into the system and interfere with the general health of the animal.

The bacilli are capable of living for some time outside the

* The leading provisions of the Tuberculosis Order of the Board were given in a circular letter to local authorities, published in this *Journal* for March, 1913, p. 1043. A further circular letter on the subject appeared in the issue for April, 1913, p. 69.

animal body, but are killed by exposure to disinfectants, to a sufficiently high temperature, or to the action of direct sunshine. In a moist state, as for example when suspended in milk, the bacilli are killed by boiling, or by exposure for a quarter of an hour to a temperature of 85° C. [185° F.].

In ordinary circumstances the tubercle bacillus does not multiply outside the animal body. Infection takes place through the taking in by a susceptible subject of the actual bacteria discharged from a diseased animal.

The Virulent Material and its Distribution.—The material excreted from diseased organs which have natural orifices very frequently contains tubercle bacilli. The number depends on the extent of the lesions and the activity of the bacilli in the lesions. The more actively the tuberculous degeneration is going on in the tissues of an organ, the more virulent are the discharges from it likely to be, but for purposes of eradication it must not be assumed that because the extent of the lesions is slight the discharges from the affected organ are not infective. Tubercle bacilli may be coughed up and excreted in the mucus from an infected lung. They may be excreted from the intestine if inner coats of the latter are the site of tuberculous lesions, or the excretions from the healthy intestine may be rendered virulent owing to infected mucus from the lungs having been swallowed. The milk from a tuberculous udder is often highly virulent, and in advanced cases of the disease the milk may contain tubercle bacilli although the udder is not affected. When the uterus is tuberculous, there is often an infective discharge from the external genital organs. Sometimes tuberculous abscesses form in connection with the superficial lymphatic glands and the skin, and the pus from the abscesses is virulent. The above are the principal methods by which the bacilli are excreted and distributed in the cowsheds and on the pastures, and even the drinking water may be contaminated. It is important to note that as a general rule the advanced cases (piners or wasters) provide by far the largest amount of virulent material.

Methods of Infection and Distribution in the Body.

Animals usually become infected with tuberculosis in one of two ways, viz., inhalation or ingestion. It is also possible

for infection to take place by inoculation through the skin, but this is not a common method of natural infection. In cattle the common method is by inhalation of air laden with tubercle bacilli. The result of inhalation of the bacilli is that tuberculosis of the lungs and of the lymphatic glands connected with them is liable to follow.

The disease is usually of a chronic nature, and may for a long time be confined to comparatively small areas of the lungs. In some cases, however, the infected areas increase in size, until a large part of the lung tissue becomes consolidated. From these areas the bacilli may be conveyed by the lymphatic vessels to the lining membrane of the chest and set up a tubercular pleurisy. From the lung lesions the bacteria may also escape into the air passages, and pass upwards to the pharynx, where some are coughed or snorted out into the air.

The majority of those which reach the pharynx from the lungs do not pass out in this way, but are swallowed, and most of these reach the outer air with the fæces of the animal.

Some of the bacilli may pass through the intestinal wall, be carried to the lymphatic glands in connection with the intestines, and set up new centres of the disease there. From these glands the disease may spread to the peritoneum, to the lymphatic glands of the udder, and from these last to the tissue of the udder itself.

The disease may also spread to the liver, kidneys, and less frequently to the tissue of the spleen. In cows the uterus is not uncommonly affected in advanced cases. The lymphatic glands of the throat are sometimes affected.

The intestines may also be infected by virulent material which has been ingested. Very frequently, however, the bacilli pass through the intestinal wall without causing lesions and lodge in the mesenteric glands, forming centres for further infection. The feeding material which is most likely to cause tuberculosis in this way is tuberculous milk. A fruitful source of infection in pigs is the mixed by-milk from creameries.

An animal may become extensively affected with tuberculosis without the bacilli passing into the blood stream. In a minority of cases the bacilli do gain access to the blood stream, and are distributed with the circulating blood over the

whole body. When that has happened the disease is said to have become generalised, and the most constant result of generalisation is the formation in the lungs of numerous small grey or yellow nodules up to the size of a hemp seed. The term *miliary* tuberculosis is applied to this form of the disease.

Symptoms.

The symptoms of tuberculosis during life are often not very distinct. Frequently there is a chronic cough and troubled breathing, with more or less anæmia and wasting. When there are abdominal lesions there is usually some diarrhœa.

In many cases the disease runs a mild chronic course, and the animals show hardly any signs of being tuberculous. In such cases the presence of the disease is sought for by the aid of a preparation named Tuberculin, which when injected under the skin of an animal affected with tuberculosis causes a definite reaction in the shape of a rise of temperature. When non-tuberculous animals are tested in this way there is no such marked effect. Tuberculin may also be applied in other ways, which it is not necessary to enter into here.

A very important seat of the disease in cows is the udder, on account of the discharge of the bacilli with the milk, and the consequent danger of infection to milk-fed animals and human beings. The udder does not usually become affected until the cow is in a fairly advanced stage of the disease.

The posterior quarters of the udder are as a rule first affected, and the disease may manifest itself in one or both of these quarters. There is a swelling, which is hard and painless. It is slow in growth, but the growth steadily progresses. Sometimes the swelling is somewhat irregular. In many cases, however, it is diffuse and very hard, and one or more quarters may be completely indurated. This is due to the excessive growth of fibrous tissue which destroys the gland tissue proper. At first the milk remains normal, but as the disease advances the milk of the affected quarter or quarters becomes thin and watery. Later it decreases in amount, and becomes flaked. The milk from the affected quarters contains tubercle bacilli, and microscopic examination of the milk may determine whether a suspected cow is affected or not. The chances of demonstrating bacilli in the

milk by microscopic examination are greatly increased by making use of the centrifuge and other methods of laboratory technique.

On post-mortem examination the lesions of tuberculosis are usually easily recognisable as such by a competent observer, without recourse to anything but a naked eye examination.

Preventive Measures.

Various schemes have from time to time been put forward having in view the eradication of the disease; most of them involve the periodical use of the Tuberculin Test, followed by the isolation, segregation, or even destruction of re-acting animals. These plans are open to criticism from the economic point of view, and no doubt if adopted generally would involve a huge expenditure, but it is beyond dispute that the disease has been eradicated from many herds by employing these methods, and sometimes with comparatively small expense.

It has to be borne in mind that the chief factor in the spread of the disease amongst cattle, and also from cattle to man, is the existence of animals in an advanced stage of the disease, and particularly of cows with tuberculous udders. These sources of infection can be removed on detection, and their removal involves no more than the destruction of animals which are already either unprofitable or would soon become so.

It should further be pointed out that the more animals are kept indoors and crowded together in insanitary surroundings, the more likely is the disease to flourish, as, given the presence of a tuberculous animal, these conditions favour the spread of the disease to other animals in contact. It must not be thought, however, that the disease can be eradicated from an infected herd by providing a generous allowance of air space, and freely ventilating the buildings, for tuberculosis has been known to spread alarmingly in excellent cowsheds, and even cattle at pasture run serious risk of infection, if they are in association with other badly infected cattle. These remarks are not intended to belittle the importance of allowing a reasonable amount of air space per animal in the cowsheds, but to accentuate the importance of ridding a herd

of the infective animals. After what has been said above it is unnecessary to enlarge upon the danger of allowing calves to suck a cow with a suspicious udder or one which is in the advanced stages of tuberculosis. The milk of such cows should not be used to nourish animals or human beings. With regard to the by-products from creameries, separated milk for example, which is employed in some districts as food for pigs, the great risk connected with its use has already been referred to. It owes its dangerous quality mainly to the fact that it is the product of a very large number of cows, and the more cows contributing to the milk supply the greater will be the number supplying tuberculous milk. Creamery products, however, can be rendered harmless by exposing them to a temperature of 85° C. [185° F.] for fifteen minutes or by bringing them to the boiling point.

Common feeding or drinking troughs should not be used, especially in infected herds.

Since tuberculous animals excrete virulent material into the cowsheds mainly from the lungs and the bowel, and since they cannot be expected to make use of spittoons and other sanitary appliances of civilisation, the need for frequent cleaning and disinfection of cowsheds, particularly the parts most liable to be contaminated by the fæces and the mucus from the lungs, is all the more pressing. In the liquid state these virulent materials may cause infection of the food or water by direct contamination, but it must not be forgotten that, if left to dry into dust, the dust may permeate the air of the cowshed, and be inhaled by other animals in more distant contact, or even contaminate their food.

BACON CURING ON THE FARM.

J. C. NEWSHAM.
Hampshire Farm School, Basing

IN rural districts there has of late years been a great decline in the curing and consumption of home-cured bacon; there are even some farmers who wash, dry, and smoke imported hams for their own table. The decline in the home-curing of bacon in this country is perhaps chiefly due to the more extensive production of mild cured bacon in factories, for

which special type of bacon the general public have acquired a taste. The "mild cured" has therefore entered largely into the dietary of the rural population of this country in place of the old-fashioned "home cured."

A further and no less contributory cause of this decline in the home curing of bacon is found in the very large importation of frozen or "chilled" meat from abroad. This meat is now sold at prices which allow it to be economically substituted for either bacon or pork, and there is no doubt that many small farmers and cottagers, who in former years would have slaughtered one or two pigs for their own use, no longer feel inclined to trouble themselves with the home curing of bacon or pickling of pork, but prefer to buy frozen, chilled, or tinned meat from the local butcher or grocer.

Weight of Bacon Pigs.—For factory purposes, buyers seldom purchase bacon hogs weighing more than from 8 to 10 score lb. Farmers, on the other hand, who want to produce bacon for home consumption, generally allow their pigs to attain a weight of from 14 to 16 score lb., and in many instances these weights are exceeded, especially in the case of old fat sows. Economy is sometimes effected when the latter are fattened in order to obtain an abundant supply of lard for domestic purposes, but where the object is simply to produce good quality bacon, farmers would do better to fatten out their bacon hogs at not more than 12 score lb. The nature and the quantity of the food fed to pigs largely determine their rate of growth; with well-bred animals there should usually be an increase of one score lb. (20 lb.) per month. A pig eight months old ought, therefore, to yield a carcass of 8 score lb., and this is perhaps the most esteemed weight on the market.

Slaughtering Pigs.—The home-curing of bacon is customarily and undoubtedly best performed during the autumn and winter months, from November to February, and although mild cures may be satisfactorily effected during the summer months by careful pickling and the use of the brine pump, yet at this time of year the disadvantages of the warm weather and the prevalence of flies have to be contended against.

A bacon hog should be fasted for twenty-four hours before killing, but may take water freely. It should never be allowed to get into a heated or excited state, or the meat will be much more difficult to cure, and will never be so mild or palatable in flavour. As a rule, the local butcher is called in to do the slaughtering, but there are many farm hands who are quite experienced enough to be trusted with it. The butcher will usually charge from 2*s.* 6*d.* to 3*s.* 6*d.* for one hog, the charge including two journeys of say two miles or so, one visit being for the actual slaughtering, and the other for cutting up.

If the farmer wishes to kill a pig himself, and is able to do it properly, it will be necessary to get a few things in readiness beforehand. If the carcass is to be scalded after killing, a large tub or tank will be required, as well as a good supply of hot water; and in order to suspend the carcass for cooling a pulley and hoist should be arranged in some airy place. Many people object to the practice of stunning the pig previous to slaughtering, contending that when the animal is rendered unconscious in this way the blood does not flow freely from the veins. There may be a certain amount of truth in this contention, but the writer has never found any ill-effects or any difficulties in the curing process when, by a blow on the forehead, the pig has been stunned before slaughter. If the carcass is to present the best possible appearance, it is essential that the flesh or skin be not bruised or marred in any way; this, moreover, would also prove detrimental to the chances of a perfect cure being effected.

Scalding and Singeing.—The pig should be ready for scalding or singeing about ten minutes after killing. In the south it is the general practice to scald porkers and singe bacon hogs, but in many other districts it is customary to scald bacon hogs. Some curers are of opinion that scalding makes the skin rather flabby, and so tends to interfere with the curing process. In many cases a perfectly clean white skin is preferred, and this can only be ensured by very careful scalding so that the surface of the skin does not lose its clearness and become browned through the use of excessively hot water. For an old coarse-skinned hog, the scald should

consist of three parts of boiling water to one of cold; while for young pigs the use of two parts of boiling water to one of cold is preferable. Any blunt instrument, such as the back of a knife, will do to scrape off the hairs, and every part of the carcass should be thoroughly cleaned in this way, the scraping being done as expeditiously as possible; otherwise the hair will be difficult to dislodge.

For singeing, a dry, shallow bed of clean wheat straw is prepared, upon which the carcass is laid, small wisps of straw being placed between the hind and the fore legs, and a thin covering over the exposed parts of the body. When the straw is set alight at the windward side the hairs will be quickly charred, and can then be very easily brushed off with a stubbly birch broom; having completed one side, the carcass should then be turned over to receive similar treatment. Care must be taken, in singeing, to avoid blistering the skin by applying too great a heat.

Cooling and Cutting-Up the Carcass.—After scalding, the carcass of the pig is hoisted to a beam by means of a gambel placed between the hind legs; and then the belly part is ripped down from nearly between the forelegs to just below the tail, and the internal organs removed, and placed on one side for further use. The toes and nails are also removed at the time the pig is opened. The workmen usually like to secure the offal and trimmings, with which to make puddings, pies, etc. In Scotland the practice still prevails of collecting the blood that drains from the carcass for making what are known as black puddings, the finer intestines being used as skins. To the blood, which is stirred and kept warm to prevent its congealing, are added various other ingredients, such as chopped fat, rice, and other materials. The larger intestines are either cooked in the form of tripe, or are reserved for making the familiar Scotch white puddings, the contents of which usually consist of coarse oatmeal, with which is incorporated the chopped renderings or residue remaining after the lard has been extracted. Both the black and the white puddings are scalded immediately after they are made, when they will keep fresh for some considerable time before using.

In opening the carcass of a pig the gut or main intestines are removed at the same time, so as to leave the tail

untouched. The liver, lungs, and heart, as well as the other minor organs surrounding them, may generally be brought out intact. Afterwards the carcass should be washed and wiped dry, both inside and out, a short stick or gambel inserted to keep the ribs apart, as otherwise a portion of the carcass may lap over and become discoloured instead of assuming its natural shape, and a stone or stick put in the mouth to keep it open; thus it may be left to cool, the leaf lard being first taken out for rendering as soon as the interior has been properly cleansed. The carcass should be allowed to cool for at least one day before being cut up.

When thoroughly stiff and cool, the head should first be removed and the carcass cut into two sides by sawing down the back from the tail to the neck. There are many different methods of cutting up a pig, however. In the south it is usual to take out the belly piece first; in Cumberland the spine is generally removed in one piece, accompanied by the breast bone and the two small ribs nearest the shoulder; the old Ayrshire curers split the carcass down the middle and afterwards hung up the two sides by hooks thrust through the gammon hocks. In the ordinary way, when the head has been removed, the "chines," or backbone, should be cut out, and removed very carefully so as not to take too great a proportion of lean meat; if thick chines are taken much of the lean meat of the back is removed at the same time, so that a fat rasher is produced as compared with that from a medium pig, where there is a fair proportion of fat and lean. Afterwards the hocks and forearms may be removed, and also the spare ribs, if the pig is a large one. The fillets, or "lean meats," are cut from the flitches, and the ham cut out at about the third joint from the tail. From the head can be cut jowls or cheeks, eye pieces, tongue, ears, and nose pieces. These pieces, together with the heart, liver, lights, etc., can be made into brawn, collared head, potted pork and tongue, etc. The leaf and other spare fat can be rendered into lard, while sausages can be made from other spare parts. When well cleaned and boiled the stomach and the chitterlings can be used as tripe, while the spare ribs may be roasted, and the lean meats used for pies.

Curing.—The curing of bacon should be conducted in a

moist atmosphere at a temperature of from 40° to 42° F. The meat may be either dry-salted or pickled, and although the former is certainly the more convenient and less troublesome method, a very large number of curers have now adopted the use of the pickle pump or syringe for injecting a suitable preparation into the meat. The carcass must always be thoroughly drained of blood and of all impurities before any attempt is made to salt or pickle it, the large blood veins being carefully removed beforehand and the carcass neatly trimmed.

As regards the different recipes for curing, it appears that many farmers and cottagers cherish secret methods, known only to themselves, and handed down from generation to generation. It is difficult to ascertain what these recipes are. One, for example, intended for sweet-cured hams, is as follows:—1 quart strong beer, ½ lb. black treacle, ½ lb. brown sugar, 2 oz. juniper berries, 1 oz. coriander seeds, 1 oz. peppercorns, 1 oz. allspice, 1 oz. cloves, 1 oz. saltpetre, ½ oz. salprunella, and last but not least, two or three onions. The spices are ground finely and the whole concoction boiled for thirty minutes; when cold it is poured over the ham, and the latter is pickled and turned every day for about three weeks afterwards.

A simple recipe for dry-salting the meat is to rub both the skin side and the inside with a mixture consisting of equal proportions of salt and brown sugar, with ½ oz. saltpetre to each pound of the mixture.

Another recipe is:—14 lb. coarse salt and 1 lb. saltpetre to a 10-score pig. For a small pig weighing not more than 8 score the carcass may be cut into four quarters, the bones removed, the forelegs cut off close up the side, and the shank bones removed from the hind legs. The four quarters are next sprinkled with 2 oz. of saltpetre, and from 3 to 4 lb. of common salt. Then they may be piled up one on top of the other and left for ten to twenty days, rolled up (Ayrshire fashion) and tied with twine, placed in muslin bags, and stored in a cool place. The quarters may be numbered according to the degree of curing, and in this way it will be possible to secure various degrees of mildness in the curing process for short or long keeping, as the case may be.

The Hampshire System.—In the Hampshire process the hams and flitches are laid on a cool stone floor, sprinkled with salt, and left for eight or ten hours; after allowing the brine to run off freely by turning them on edge for a little while, the skin side of the flitch is rubbed thoroughly with salt, the shanks being stopped with salt and saltpetre. Salt, saltpetre, bay salt, pepper, and sugar all enter into this process. Some curers put the sides into a "silt" of strong brine, after which they are taken out and dry-salted on a bench for from fourteen to twenty-one days, according to the size of the flitches. The flitches are stacked on a cool stone floor rind downwards, one on the top of the other, and at the end of about three days their positions are reversed, the bottom flitch being brought to the top and the top to the bottom. This process is repeated at intervals about six times, and subsequently all the stale briny salt is rubbed off, and each flitch is well covered with fresh bran or sawdust, after which it is hung in the drying loft for two weeks or more. Much Hampshire bacon is cured on old-fashioned rule-of-thumb methods, the curer using his own discretion as to the quantities of ingredients used.

A Yorkshire Recipe.—In the Yorkshire process black and white peppers are added as a flavouring, but they are expensive, and no more than 7 oz. should be used. A dry antiseptic is necessary in every case. Non-poisonous antiseptics are better than saltpetre, and sulphate of soda, boracic acid, or sodium fluoride can all be used with much greater advantage than saltpetre. Decomposition more readily sets in where no antiseptic is used, especially when the flesh is not properly cleansed of the impurities of the blood and the blood veins.

A Buckinghamshire Cure.—An interesting Buckinghamshire method of curing bacon is as follows:—Each flitch is well rubbed with 2 oz. of finely pulverised saltpetre, special care being taken to apply a larger quantity of the antiseptic to the parts where the ham and shoulder have been removed. A mixture of 7 lb. of salt and 1¼ lb. of coarse moist sugar is then heated in a frying-pan, and the flitches are rubbed all over with this hot mixture; then they are placed one on top of the other in a salting pan, and well basted and rubbed with the brine that commences to form; this treatment is con-

tinued for some time, and the sides are turned twice a week in the meantime; at the end of four weeks they will be ready for smoking. The two hams are cured simultaneously with the flitches, and are hung on nails or put on a bacon rack in the kitchen, till they are quite dry externally, and have the remaining pickle crystallised on the surface; they are then hung in the chimney or smoke loft to undergo the action of the smoke from the wood fires.

The Cumberland System.—Sugar enters into the Cumberland recipes, a typical one being as follows:—4 stones of salt, 4 to 8 lb. pure Demerara sugar, and from 1½ to 2 lb. of saltpetre. In the Cumberland district it is customary to rub the hams thoroughly with the salt at intervals of four or five days. The other ingredients are added after the second application of the salt and the bacon smoked after the lapse of another week.

Scotch and Irish Methods.—A Scotch recipe that appears to give very good results consists of:—8 lb. of dry common salt, 3 oz. of saltpetre, 1 lb. good brown ration sugar, and 1½ oz. allspice for every 100 lb. of flesh. The carcass is allowed to cool, after cutting up, for about twenty-four hours, and the salt is rubbed in the skin side with a stone, until every part of the rind is soft, white, and pasty; then the sides are well salted by hand, piled up, and left to drain for forty-eight hours. When all the brine has been discharged from the flesh, a mixture of half the remaining salt and saltpetre is well rubbed in, and afterwards the balance of the salt and saltpetre, together with the sugar and allspice, is applied in a similar fashion. The brine that came from the first salting is thrown away, but the second brine is used to baste the sides every day or so for about three weeks, after which the bacon is hung up to dry. In Scotland and Ireland a cure known as "green" bacon is held to be very popular; after curing, the sides are rolled and bound with twine, placed in muslin bags, and stored in a cool place. The essential properties of Irish bacon are no doubt due to the use of peat turf in drying it.

Pickling Bacon.—A really good quality mild cured bacon can never be obtained unless the brine or pickle is injected into the side with the brine or force pump, after which opera-

tion all that is necessary in order to complete the pickling is a sprinkling of dry salt, the hams being turned at intervals for about two or three weeks, when they will be ready for smoking.

Pickling ensures that the meat is salted more uniformly than in the case of dry salting. A good pickle for the purpose is composed of 1 lb. of saltpetre, 1 lb. of dry antiseptic, 1 lb. of black sugar or 1 pint of treacle, and 11 lb. of common coarse salt with water to make up 4 gallons. This pickle is a suitable one for hams. For bacon, the following ingredients may be boiled together and the concoction afterwards skimmed quite clear before using:—14 lb. of salt, 1¼ lb. of saltpetre, 1¼ lb. of dry antiseptic, and 1½ lb. of cane sugar with water to make up 3 gallons. A salinometer, which is a modified form of hydrometer, is necessary when using a pickle for bacon; otherwise it is impossible to tell whether the mixture is at the right strength. The salinometer should register 100 degrees; if it registers less than this more salt should be added.

In curing hams, the needle point of the pickle pump should be inserted in all the fleshy parts of the meat, and the pickle injected, especially into that portion of the meat in close proximity to the bone, as it is here that there is most risk of decomposition arising, through a portion of the blood and other animal juices becoming locked up, as it were, in the tissues of the flesh. The hams should be allowed to soak in the pickle for about forty-eight hours, and then all the liquid must be squeezed out by means of thumb pressure, repeated in the direction of the blood veins. A coarse, dry cloth is then used to dry the hams thoroughly, and they are afterwards placed in a fresh pickle or laid rind downwards on a cool stone floor and covered with a layer of salt from ½ to 1 inch thick. A sprinkling of equal parts of dry antiseptic and saltpetre, just about enough to whiten the surface, should then be given, and this in turn covered with another layer of salt. Hams may also be cured by steeping them in the pickle contained in a tank. After leaving them in the pickle for a day they should be taken out and the blood veins squeezed, as already advised; then the hams are wiped dry and placed in a fresh lot of pickle and left there for two or three weeks, according to whether a mild or full-flavoured ham is required.

A mixture of dry antiseptic and salt is then sprinkled over the cut surfaces and the hams are thickly covered with salt. For mild cured bacon pigs, weighing from 7 to 9 score lb., nine days in salt are required; for 9 to 10 score pigs, eleven days; and 10 to 11 score pigs, twelve days. For bacon that is required to be kept for a year or more, about twenty-one days in salt would be required, and for ordinary dried bacon, smoking will be necessary after the sides have been washed free of salt.

Smoking.—In the ordinary way hams and flitches will be "pale-dried" in about three days in a dark room at a temperature of about 85° F. While green or unsmoked bacon is preferred in the north, south country consumers like the smoked bacon best. Some of the old smoke lofts for bacon in old-fashioned farmhouse kitchens in the south are still in use. The modern method of smoking bacon is much more speedy and effective, however. Any convenient outhouse can be utilised for the purpose, but the chief thing to guard against is the risk of fire; and, further than this, care must be taken to see that the smoke does not escape from the building through apertures in the roof. An earthen floor may be used, but a cement floor is best, and any openings at the eaves can be stuffed with straw, or damp sacking may be laid over the roof to keep the smoke in. In the first place, the flitches and hams should be thoroughly dried in the open air during windy or drying weather. Meanwhile, the floor of the outhouse or smoke-room should be covered with a layer of several inches of clean, dry wheat straw, on the top of which is placed a layer of oak sawdust 3 or 4 inches thick. If the latter is damp there will be some difficulty in getting it to burn properly; green sawdust will not burn at all. Before smoking it is usual to dust the hams and flitches with pea meal, so as to impart to them that rich brown tint so characteristic of Wiltshire bacon. The hams are afterwards packed in thin calico or flour bags and hung up in a dry kitchen, but care must be taken to see that they are not kept near a hot ceiling, or partial decomposition may be induced. The custom still prevails in many north country farm houses of keeping flitches and hams in meal, and some very excellent green bacon is often stored in this way.

BOTANICAL CONSIDERATIONS AFFECTING THE CARE OF GRASS-LAND—*continued.*

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Botanical Characters of Grass-Land (continued).

(3) *The Quality and Quantity of the Gramineous Flora, and the Ratio of the Valuable to the Useless Grasses all the Year Round.*—This subject has received more detailed attention than any of the others. By a series of exact analyses made on the ground, Armstrong * has shown what the real ratio of the contributing species is to each other on some of the best pasture land in England. Working on the same method the writer has † studied the relation of species on a number of pasture types on the Cotswolds. Reference to the great majority of manurial reports is, however, disappointing, for little light is thrown on the botanical composition of pastures in relation to the geological and soil factors of habitat. Tansley, in "Types of British Vegetation," has broadly outlined some of the salient features of the main types of grass-land, and reference to the ecological literature he cites at the end of the book will supply the agriculturist with a fund of information on this important question.

There can be no doubt that a clearer recognition of definite pasture types will serve to throw much light on the question of the care of grass-land. The data so far collected are very meagre in proportion to the importance of the subject, but they seem to afford valuable information as to the vexed question of sowing down land to grass. At present all our knowledge on the effect of different manures on species is based on summer and autumn analyses made by sorting the cut herbage. These results have shown to some extent the

* *Jour Agric. Science*, Vol. II, Part 3

† R G Stapledon: "Pasture Problems: Drought Resistance."—*Jour. Agric. Sci.*, Vol. V., Part 2.

seasonal changes that take place on grass-land. Armstrong's analyses made over a long period, and the writer's made right through the winter, have shown these changes to be very considerable. Consequently, before much can be asserted in regard to the specific action of manures, it is important that plots should be analysed (1) under hay crop, (2) in October, and (3) in February or March.

Experiments have shown, however, that plants respond to manures, not only according to their needs, but also according (1) to their original degree of abundance on the plots; (2) to the response of all the other contributing species; and (3) to the nature of the habitat. Further, it may be stated that the effects of manures may be completely masked by changes in the soil or other conditions of the plots, or by unusual meteorological conditions.

In support of these propositions the following examples may be cited. *Agrostis stolonifera* is always said to be considerably increased by the addition of sulphate of ammonia to the dressing. When, however, this grass is originally present in considerable quantity (60 per cent. and upwards) it may be actually decreased by this manure; when existing in the proportion of about 50 per cent. it will not be much increased; when present to the extent of only 10 per cent., great increases are to be expected, while when only sparingly present great increase is unlikely. The following figures (representing percentages present) are quoted in support of these statements :—

	Unmanured.	Sulphate of Ammonia.
Tree Field, Cockle Park, Bull No. 8.	Per cent	Per cent.
June 25th, 1903,	13·0	16 5
August 3rd, 1903	76 5	55 0
Manor Farm, Garforth, No. 85. July, 1909.	53 4	57·29
Rothamsted Park Hay. 1862.	11 36	24·3
R.A. College, Cirencester. 1912.	·3	·1
Latton, Cirencester 1912.	10·0	15·9

Again *Festuca ovina* is, ordinarily speaking, increased by the addition of sulphate of ammonia; but it conforms to the

above rule, as the following figures of percentages show:—

	Unmanured.	Sulphate of Ammonia.
	Per cent	Per cent
Tree Field, Cockle Park June 25th, 1903	33·5	18·5
Manor Farm, Garforth July, 1909	1·94	1·11
Rothamsted Park Hay. 1862	13·3	21·9
R A College, Cirencester 1912	4·4	11·8
Latton, Cirencester 1912	18·2	24·7
Dry Leaze, Cirencester 1912	24·6	23·6
Tarlton, Cirencester 1912	6·2	14·0

As a further example, figures showing the effect of phosphates on Cocksfoot (about which no generalisations are usually made) were selected at random from the writer's notes on the subject, with the following result:—

	Unmanured	Phosphates
	Per cent	Per cent
Tree Field, Cockle Park June 25th, 1903	0·0	11·5
Manor Farm, Garforth July, 1909	3·4	29·6
Rothamsted Park Hay 1862	1·76	2·2
R A College, Cirencester 1912	3·2	14·2
Dry Leaze, Cirencester 1912	4·1	9·0
Latton, Cirencester 1912	7·6	8·0
Tarlton, Cirencester 1912	18·5	17·6 and 13·9

The evidence afforded by these figures cannot be controverted, and if the behaviour of Cocksfoot is compared with that of *Agrostis*, it appears that its response to nitrogenous manures differs only in degree and not in kind from that of *Agrostis*. With regard to the effect of soil and other changes in the plots, the reader may refer to "Experiments on Permanent Grass-land." * The whole question of the specific response of plants to manures is decidedly obscure.

With regard to the quality of grasses it should be emphasised that "valuable" and "useless" are terms of comparison only, and that the value or uselessness of a species, with but few exceptions, is a matter of degree, of habitat, and of use. It is on this point, in particular, that a study of types of grassland is illuminating. It may be said that any species that will

* Kinch and Stapledon "Experiments on Permanent Grass-land"—*Agric. Student's Gazette*, August, 1902

flourish in an unfavourable habitat, on which the orthodox species will not luxuriate (provided that stock will eat it without harm to themselves, and apart altogether from evidence afforded by its chemical composition) is, for that habitat, a valuable species. Two examples will serve. (1) Creeping Heath Grass (*Triodia decumbens*) contributes largely to the herbage of many sheep walks in Wales, and supplies a certain quantity of green herbage, which is eaten with avidity by sheep all through the winter. Thus, this plant, although valueless in good types of grass-land, is on these walks an important factor in the winter keep of sheep. (2) The Upright Brome (*Bromus erectus*) is able to produce big yields of hay on thin soils. The hay is coarse, but readily eaten by stock. Judiciously managed, this is an important plant on Oolite and Chalk soils. As to the orthodox pasture plants, it is obvious that they are only valuable on habitats where they are capable of attaining a reasonable luxuriance; so that on poor situations a robust, luxuriant endemic species is of more value than a starved and slightly herbaceous rye-grass or meadow fescue. This leads naturally to a discussion of the next and closely allied problem.

(4) *The Condition of the Useful Plants in Regard to the Production of Nutritious Herbage.*—Hall and Russell * have pointed out the remarkable differences in the nutritious herbage from two apparently similar fields. The case they studied would seem to have been a particularly puzzling one. The relation of the weed flora to this phenomenon, as manifest on a number of fields, has already been discussed. In general, analyses of a number of pasture types on all manner of habitats would seem to justify the following broad generalisations:—Grasses produce a maximum of nutritious herbage when grown on well-aerated deep clays and loams; stagnant conditions induce either a very rank tufted growth or a dwarf, sparse herbage; dry and starved conditions encourage excess of culmy, fibrous inflorescences.

The growth form of grasses varies very much. *Agrostis,*

* Hall and Russell "On the Causes of High Nutritive Value and Fertility of the Fattening Pastures of Romney Marsh and Other Marshes in S.E. England"—*Jour. Agric. Science*, Vol. IV., Part 4, p. 370

Sheep's Fescue, Perennial Rye-grass, Cocksfoot, and Timothy are particularly plastic. The chief differences are: (1) the production of much or little fibrous inflorescence; (2) a very close-matted growth (*e.g.*, Perennial Rye-grass where water stagnates, or Sheep's Fescue and *Agrostis* on wet flushes on moorland sheep walks); (3) a densely-tufted coarse growth (*e.g.*, isolated plants of Perennial Rye-grass growing as a weed on arable land, or Sheep's Fescue on some sheep walk positions); and (4) a tendency for a normally tufted grass to assume a creeping habit (*e.g.*, Rye-grass and Cocksfoot, the latter particularly after the drought of 1911).

The real vegetative condition of the herbage can only be realised by (1) observations made in summer when the grasses are in flower, and (2) observations made in late autumn or winter (November is probably the best month), when a good idea can be formed of the relation of tufted to good turf areas, stagnant spots can be easily recognised, and the weed flora can be fairly estimated.

(5) *The Nature of the Aggregate Root System of the Pasture or Meadow.*—The relation of the root system to the production of herbage must be very close. Definite root analyses have, however, not been attempted. They present a wide and promising field of study.

(6) *The Degree of Productiveness of the several Useful Plants throughout the Year.*—Other things being equal, a pasture plant is valuable in proportion to the length of time it maintains a maximum of green herbage. It is surprising that no reliable data have been collected on this point, for pasture plants vary very much in this respect—both specifically *inter se,* and also according to the nature of the habitat. Excessively wet and excessively dry situations generally carry the least herbaceous vegetation through the winter; also the plants "dry off" earlier in the autumn, and on the excessively wet habitats start into growth later in the spring. Exposure to wind has a marked influence on herbage, as can be noticed in walking over any mountainous or hilly district in winter. The effect of moss on herbage is also very well marked. When in great excess in very wet situations, it tends to rot the leafage, and so decreases the herbage; in moderate excess it protects the gramineous vegetation, and so favours growth. This is

especially seen on mountain sheep walks where mossy banks are grazed with avidity by sheep all through the winter.

Of specific differences, the Meadow Vetchling on most habitats is markedly devoid of leaves all through the winter, and produces very little aftermath in the autumn. Dutch Clover is only partially green in winter. Of the grasses, the Blue Moor Grass (*Molinia cærulea*) may be said to have no green leafage through winter in practically all habitats, and from this grass a gradation may be traced (but habitat is always an important factor) through Tall Oat Grass (sometimes practically devoid of leaves), Creeping Heath Grass (*Triodia decumbens*), which is sometimes remarkably herbaceous under moss, Tall Fescue, Cocksfoot, and Sheep's Fescue to Crested Dog's Tail, which, in average habitats, affords abundance of green forage all through the winter. *Agrostis* varies from no green leafage to almost complete growth of leaf, according to habitat. These analyses have not been carried nearly far enough; it should be possible ultimately to arrange all the species on a scale according to their average winter productiveness of foliage.

It is evident from the analyses already made that the average pasture, considered as a whole, has no regular seasonal period of hibernation; some of the plants are slightly vegetatively active at all times, except presumably during periods of intense frost. Nevertheless, a great change does come over grass-land about the middle of November, most of the species certainly becoming partially dormant about then. This period of partial hibernation is, however, for average good pastures but a short one—for by the middle of March, or even the middle or beginning of February in some years, considerable vegetative activity is again manifest. It is probable that deterioration of much pasture land is primarily due to this shortened period of partial hibernation. The effect of manures on growth of foliage has not formed the subject of critical investigation.

(7) *The Quality and Quantity of the Moss Flora throughout the Year.*—Moss has always been regarded as a serious weed on pastures; its effect on foliage has, however, been noted. The specific mosses which occur on various types of pastures and meadows (as, indeed, also the specific fungi)

have not formed the subject, as far as the writer is aware, of systematic comparative study. Moss is always most plentiful in winter and early spring, rapidly diminishing as the grasses begin to assert themselves in later spring. February analyses show moss at its maximum, when it may amount to as much as 44 per cent. of the total dried produce from a field. Natural pastures in moorland districts show least moss under the shade of tufted grasses (*e.g., Nardus, Molinia,* and Tufted Fescue), and most on banks where the herbage is short. This fact corroborates Elliot's dictum that an excellent way to eliminate moss is to allow the herbage to stand as foggage all through the autumn and winter.

The factors affecting each of the above considerations have been briefly alluded to. In order to illustrate their exact bearing on grass-land problems it will be convenient to discuss in a general manner some controversial questions, and to allude to certain modifications that have suggested themselves as the result of an extensive series of analyses made on a great number of pasture types—analyses made with a view to a better understanding of the phenomena that have to be considered.

The Care of Grass-land.

Manuring.—The phosphatic manures have proved to be most efficient in regard to permanent improvement of grass-land. With basic slag, if nitrogenous manures are used at all, it is found desirable to postpone their application till after the slag has produced its maximum effect on the clovers. The success of basic slag is dependent on a number of well-recognised factors, two botanical factors being (1) the original presence of Dutch Clover or other responsive plant, and (2) space for the clover or other plants to spread. Excess of *Agrostis* and of miscellaneous herbage is a botanical factor most antagonistic to adequate spread of the clover. On fields where these factors are markedly operative it would be interesting as a plot experiment to try the expedient of first dressing with sulphate of ammonia, if necessary for two years in succession. This will be sure to diminish the miscellaneous herbage, and, as previously shown, if the *Agrostis* is really excessive, the dressing may also decrease it, or, at the worst, will only occasion

a slight increase. Then, in the autumn following the treatment, dragging with a toothed harrow might be carried out. This will do much to eliminate the *Agrostis,* and in February the usual heavy dressing of basic slag could be harrowed in.

Aeration.—The success due to harrowing grass-land before applying basic slag, as demonstrated by Bryner Jones, has already been alluded to. Turner at Cirencester produced excellent results on a meadow where *Bromus erectus* was excessive by autumnal harrowing with a toothed harrow. These examples show that the toothed harrow may not be without its use on pastures. There are hundreds of acres of pasture land, of a quality insufficient to fatten a bullock, which have none the less provided valuable keep over a long season for horned stock. There is often a tendency, especially when Crested Dog's Tail and other "winter green" grasses are prevalent, to depasture such fields, practically through the whole winter, more particularly when they are near the homestead. The result is, especially in wet seasons, when the fields lie low, that the soils become more and more puddled, compressed, and hardened each successive year. This reacts also upon the summer condition of a field, when the soil is apt to cake hard under the influence of the sun. In short, the pasture gradually loses condition, *Agrostis* and mat-herbs greatly increase, and coarse tufted patches of undesirable herbage also become manifest. The process is a slow one, but there can be no doubt that much good grass-land has slowly deteriorated chiefly as a result of winter puddling by stock.

Impaired aeration is probably the chief factor in bringing about this state of affairs.

Soil condition would to some extent be restored by dressing with lime, and better aeration should result from the use of the toothed harrow. Prevention, however, is better than cure.

Change of Husbandry.—It is often urged that fields should be set apart, either as pastures or as meadows. This is doubtless quite sound on soils suited to the really first-class types of grass-land. Botanical analyses on both pastures and meadows of moderate quality, however, suggest that either practice when long continued leads to deterioration of the herbage.

(1) Fields that have been long depastured are subject to a continued and accumulative treading; the plants are allowed to produce but little inflorescence; and the sun-enduring mat-herbs (plantains, &c.) are sure to become very excessive, as also are the creeping and spear thistles, and on wetter spots meadow-sweet and even rushes. If, however, hay is periodically taken, the mat-herbs will tend to be kept in place; and thistles, meadow-sweet, &c., being more essentially pasture weeds, will gradually disappear under mowing. There are doubtless other factors that would be brought into play. In any event, in the case of deteriorating fields, the mere alteration of conditions may be expected to produce good results, although we may be ignorant of the true causes of the benefit.

(2) In the case of fields continually hayed, the trouble on poor soils is perhaps more obvious. The plants yearly run to seed, and this means an accumulative tax on their vegetative organs, especially when manures are consistently withheld; further, the vegetative organs develop less and less well, as is manifest by the falling off in the yield of hay. This is well exemplified by reference to the behaviour of an unmanured plot in connection with any long-continued series of experiments. At Rothamsted * in the experiment on grass-land the average yield of hay in the first eight years (1856–1863) was 2665 lb. per acre, and the average for the ten years 1876–1885 was slightly higher, namely, 3025 lb., but the average for the five years 1896–1900 showed a considerable decrease, being only 1568 lb. At Cirencester † the average yield of hay at the commencement of the experiment 1889–1892 was 22 cwt. per acre; for the five years 1897–1901 it was 20 cwt.; and for the five years 1905–1909 it was 15 cwt. Thus at Rothamsted the yield was well maintained for twenty-nine years, and then began to fall considerably. At Cirencester it was well maintained for eleven years, and then began to fall rapidly. These facts clearly show that different fields vary considerably in regard to the length of time that will elapse before natural deterioration sets in, but when once it does set in, the gradual falling-off seems to be continuous. The plants each successive year apparently produce less and less herbace-

* A. D. Hall. "An Account of the Rothamsted Experiments." London, 1905.
† *R.A. College Scientific Bulletin* No. 1, 1909.

ous growth in proportion to their inflorescences.* Consequently, the hay gradually deteriorates in intrinsic value as well as in bulk, since in proportion as it is culmy and consisting largely of flower stalks, so is it fibrous and innutritious.

Again, in proportion as the yield becomes thin, the weed plants gain on the ground. At Rothamsted the percentage of weeds on the unmanured plots in 1862 was 21·29; in 1877 it was still 20·31, but the hay yield had slightly increased during that interval; by 1903, however, the proportion of weeds had risen to 40 per cent. In round numbers, whilst by the period 1896–1900 the hay yield had fallen by 40 per cent., by 1903 the miscellaneous herbage had increased by 100 per cent. Striking as these figures are, it must be remembered that they are derived from analyses made on the cut herbage, and are therefore not reliable guides as to the behaviour of the weed flora.† Two definite cases of meadow deterioration have come under the notice of the writer. Both are now being treated as pastures, and are showing improvement of their herbage in consequence.

Enough has been said to show that pastures and meadows afford scope for very detailed researches. As the case stands at present, all that can be asserted is that the herbage of failing meadows tends to be improved by continued depasturing, and an explanation can only be given in general terms. The grazing will tend to restore a more desirable balance between seed production and vegetative growth, for it must be remembered that most of the grasses are perennial plants, and like most perennials their length of duration as robust individual plants is dependent on a moderate annual production of seed.‡ The yearly withdrawal of hay further tends to deprive the soil of plant food. This, together with the consequent increase of mat-like and other weeds, produces a cycle in regard to the physiological relations between the nutritious plants

* The appearance of plots and of deteriorating fields justifies this statement; and it is a well-known fact that starved plants habitually run to seed. The number of inflorescences per unit of area on manured and unmanured plots and on good and deteriorating fields should, however, be ascertained.

† The writer's experience of analyses made on the ground would suggest an even more striking result.

‡ The case of the ordinary garden Mignonette, which, if the flowering buds are continually plucked, may be made to assume the character of a shrubby perennial, is familiar to everybody, and is not without its bearing on the above problem.

and the habitat (including competitive weeds), which becomes more involved and more vicious as the years go on. It can be combated only by radically altering the prevailing conditions; the best plan is to resort to grazing, and, in most cases, it is probable that a full mineral dressing with the addition of sulphate of ammonia would be justified. The sulphate of ammonia will act in a three-fold manner: (1) by increasing the herbaceous growth of the grass; (2) by consequently tending to shade out the mat-herbs; and (3) by its direct effect on weeds it will further decrease them.

Different Treatment within the Same Field.—Botanical analyses show that, except in the case of the best pastures, fields vary very much within themselves. On the Cotswolds, for instance, Meadow Foxtail is often found in considerable clumps, occupying patches of soil which are deep in comparison with that of the rest of the field. Meadow Foxtail on calcareous soils responds particularly well to farmyard manure. Clumps manured with farmyard dung would tend (since the grass is decidedly stoloniferous) to extend their bounds, and thus add to the amount of the valuable early bite afforded by this plant. This example introduces a principle which might be much extended.

Conclusion.—Botanical data collected on the lines suggested in this article have also an intimate relation to the question of seeding down land to grass. This subject, however, is too complex for discussion briefly in general terms.

Experience shows that chemical analyses of soil are not so informing in regard to the care of grass-land as they are in relation to arable husbandry.* This is largely due to the heterogeneous nature of the flora of grass-land, many more or less definite plant types occurring on one soil type, changes being due to a number of more or less adventitious circumstances not yet clearly understood.

It is hoped that this article will establish the need of obtaining really accurate botanical data in regard to all grass-land problems. Such data are especially desirable in connection with the numerous plot experiments on grass-lands that have

* Hall and Russell "On the Causes of High Nutritive Value and Fertility of the Fattening Pastures of Romney Marsh and Other Marshes in S.E. England."—*Jour. Agric. Science*, Vol IV, Part 4, p 370

been undertaken by agricultural colleges and county officials. If the results from all centres could be correlated on a reasonable basis, something more valuable than empirical information might be confidently anticipated.

SOME DOUGLAS FIR PLANTATIONS.

II.—COCHWILLAN WOOD, NEAR LLANDEGAI, NORTH WALES.

THOS. THOMSON, B.Sc.

1. *History and General Description of Sylvicultural Conditions.*—Cochwillan Wood is situated on level ground on the east bank of the Ogwen River. The plot measured is close to the bank of the river, and has a good loamy soil, which is probably alluvial, and an elevation of about 170 feet above sea level. Higher ground lies to the west, but, owing to their great height, the tops of the trees are exposed to westerly winds.

The wood consists mainly of a mixture of Douglas fir and oak, the former being rather irregularly scattered over most of its area. At its northern extremity, however, there is a small portion which consists of a pure crop of Douglas fir, and the plot measured was in this part, being selected so as to include as much of the pure crop as possible without at the same time including any of the marginal trees. The Douglas firs were originally raised in pots from seed obtained from a tree in Penrhyn Park that is still to be seen. At the time of measurement (March, 1913) the wood was about fifty-eight years old.

2. *Method of Measurement.*—The plot was measured by means of a chain, and stakes were inserted at the corners, so that its boundaries are permanently marked. The area of the plot was found to be 0·421 acre.

The diameter of each stem at 4 feet 3 inches from the ground was measured by means of callipers, two diameters at right angles being taken and their mean recorded to the nearest half-inch. The heights of a number of stems were measured by means of Weise's hypsometer and a number of others by a plumb-line and rod, a man climbing the trees for

Diameter. Class.	Number of Stems.	Stem Area at 4 ft. 3 in.	Mean Height.	Stem Area × Mean Height.
Inches		Sq. feet.	Feet.	
12	1*	0·7854	58	45 5532
13	1	0 9218	73	67 2914
15½	1	1 3104	84	110 0736
16	1	1·3963	86	120 0818
16½	1	1 4849	88	130 6712
17½	1	1·6703	91	151 9973
18	2	3 5342	92	325·1464
18½	2	3 7332	94	350·9208
19	1	1 9689	95	187 0455
19½	2	4 1478	96	398 1888
20	1	2 1817	98	213 8066
20½	2	4 5844	100	458 4400
21	2	4 8106	101	485 8706
22	2	5 2796	102	538 5192
22½	2	5 5222	102	563 2644
23	1	2·8852	103	297 1756
23½	2	6 0240	103	620 4720
24	4	12 5664	103	1294 3392
24½	1	3 2748	104	340 5792
25	3	10·2264	104	1063 5456
25½	5	17 7325	104	1844 1800
26	1	3·6870	104	383 4480
26½	2	7 6602	104	796 6608
27	2	7 9522	104	827 0288
27½	1	4·1248	104	428 9792
28	1	4·2761	104	444 7144
29	1	4 5869	104	477 0376
Total	46	128·3282	—	12,965·0312

* Cedar.

NOTE.—The heights of the Douglas Fir measured varied from 88 to 115 feet.

the purpose.. These heights were plotted on squared paper against the diameters of the trees, and a height-curve drawn. The heights thus calculated were used as the mean heights of the trees of the various diameter classes. The sum of the products of the stem-area of each diameter class into the mean height of that class, divided by the total stem-area, gives the mean height of the trees in the plot. The total stem-area divided by the number of stems gives the mean sectional area at breast-height of the average stem. The detailed figures are set out in the table on p. 500. The dimensions of the mean stem were calculated to be:—

Height = 101 feet.
Mean diameter at breast-height = 22·6 inches.

A tree was sought which gave these dimensions as nearly as possible, and one was found close to the plot, although not actually in it. The actual dimensions were: Height = 100·5 feet, and mean diameter = 21·7 inches, the sample tree being, therefore, slightly smaller than the mean tree. This stem was felled and measured, and form factors were calculated from it and applied to the plot in estimation of the total volume. The volume of the sample tree was calculated by the quarter-girth method, and, in order to ascertain the true contents, the stem was also measured in ten-foot sections, the mean diameter at the middle of each section being measured with callipers. The results are given in the following table:—

	Length.	Girth at half height.	Volume over bark (Quarter girth).	Volume measured in 10 ft. sections.
	ft. in	inches.	cub. ft	cub ft
Stem over 3 in. diameter	89 3	50·5	97 0	113 959
,, ,, 6 in. ,,	79 4	52 0	93·0	112 996
,, ,, 12 in. ,,	59 9	57·5	83·5	103 995

The total contents of the stem measured in ten-foot sections were found to be 114·066 cubic feet.

The form factors calculated from these measurements, using the formula

$$\frac{\text{Volume}}{\text{Total height} \times \text{Stem area at breast height}} = \text{Form Factor}$$

are as follows :—

	Form Factor True Contents.	Form Factor Quarter Girth
Timber to 3 in diameter ...	0 443	0·379
,, 6 in. ,,	0·438	0·360
,, 12 in. ,, .	0 403	0·323

3. *Estimate of Volume of Timber.*—The measured plot was found to contain fifty stems; of these, one was a cedar, and four were broken. The cedar, which had a diameter of 12 inches and height of 58 feet, has been treated as a Douglas fir for the purpose of measurement. The four broken stems have, however, been excluded from the calculations described above, but have each been separately measured; the height of each was taken with a plumb-line (the main stem only being considered and any new leaders ignored), and the girth with a tape at half that height. The dimensions of these stems are as follows :—

Diameter at 4 ft 3 in	Stem area at 4 ft. 3 in.	Timber height.	Girth at half Timber height	Mean diameter at half Timber height
inches.	sq ft.	ft in	inches	inches
16½	1 4849	33 0	43	14
17½	1 6703	52 0	40	12 5
17½	1 6703	46 10	46	14 5
23	2 8852	34 6	60	19
Total	7 7107	—	—	—

Area of middle section.	Volume to 3 in. and 6 in diameter	Volume to 12 in diameter (estimate)	Volume to 3 in and 6 in diameter (quarter girth)	Volume to 12 in diameter (quarter girth) (estimate)
sq. ft	cub ft	cub. ft	cub ft.	cub ft.
1 0696	35 27	27	26	20
0 8523	44 32	26	36	19
1·1467	53 70	30	43	22
1·9689	67 92	67	54	54
Total	201 21	150	159	115

Adding the volumes of the broken stems to the unbroken stems, the total contents of the plot are as shown in the following table —

	Number of stems	Stem areas at 4 ft. 3 in.	Mean diameter at 4 ft. 3 in.	True Volume over Bark.		
				Timber over 3 in diameter (f.f. 0·443)	Timber over 6 in. diameter (f.f. 0·438).	Timber over 12 in. diameter (f.f. 0·438).
		sq. ft.	in	cub ft	cub ft.	cub. ft.
Unbroken trees.	46	128·3282	22·6	5,740	5,680	5,220
Broken trees.	4	7·7107	18·8	200	200	150
Total for 0·421 acres	50	136·0389	22·4	5,940	5,880	5,370
Total per acre	118·7	323·13	22·4	14,110	13,970	12.750
Mean Annual Increment				243	241	220

	Number of stems	Stem areas at 4 ft. 3 in.	Mean diameter at 4 ft. 3 in.	Quarter Girth Volume over Bark.		
				Timber over 3 in diameter (f.f. 0·379)	Timber over 6 in. diameter (f.f. 0·360).	Timber over 12 in diameter (f.f. 0·323).
		sq ft	in	cub ft	cub ft	cub ft
Unbroken trees	46	128·3282	22·6	4,910	4,660	4,190
Broken trees	4	7·7107	18·8	160	160	110
Total for 0·421 acres	50	136·0389	22·4	5,070	4,820	4,300
Total per acre	118·7	323·13	22·4	12,040	11,450	10,210
Mean Annual Increment			...	208	197	176

THE CULTIVATION OF CARROTS.*

EDWIN BECKETT.

THE carrot (*Daucus Carota*) occurs wild in Great Britain, and is also indigenous to several other European countries. It appears to have been cultivated in the Mediterranean long before it was grown in this country. The carrot is one of the most important crops grown in the kitchen garden, and during recent years considerable improvements have been made in the list of varieties best suited for growing at different seasons, so that it is now possible to obtain with com-

* The system described is that in vogue in private gardens, and is not that practised by commercial growers

parative ease fresh young succulent roots during the greater part of the year.

For very earliest supplies a sowing should be made quite early in the new year, under glass, in pits or frames, and preferably where there is a flow and return hot-water pipe. Failing artificial heat, with careful attention excellent crops may be obtained from portable frames or mild hotbeds. These should be made up with long stable litter and fresh leaves in equal parts; but before placing together too tightly, the rank heat must be allowed to escape. They should be built up firmly and large enough to take the frame and admit of a lining of similar material being placed round it. For the early maturing forcing varieties a depth of about a foot of rich fine soil will be needed, and this, when finished, must not be too far from the glass. The seed may either be sown broadcast or in drills; the drill method is often practised and the intervening spaces filled with radishes, which are utilised long before the carrots attain any size. If preferred, the drills may be drawn quite closely together, as the amount of top with the early varieties is not very great. The seed should be just covered with the fine surface soil, and then given a good watering through a fine rose so as not to disturb the seedbed; the frame should then be kept fairly close.

As soon as the seedlings are discernible a little ventilation will be needed, though this must be given cautiously, avoiding cold draughts. Once or twice daily, according to the conditions prevailing out of doors, the surface soil and the surroundings may be damped over with the syringe, using water which has been raised to the temperature of the atmosphere inside the frame. Thinning should be commenced quite early, but be carried out gradually, taking out only enough to prevent those remaining becoming drawn, as later thinnings, though only quite young, will be appreciated.

Green fly sometimes proves troublesome in frames or in glass structures, though syringeings will do much to keep it in check, and a light fumigating with nicotine compound will effectively destroy it.

During February and March successional sowings may be made in the same manner, and will maintain the supply until

the earliest are pulled out of doors. When a sufficient depth of suitable soil can be placed together in a deep pit, the intermediate varieties may be grown in a similar manner and excellent material obtained for the table by gradual thinnings.

For early sowings out of doors, a sunny, sheltered position, such as a sloping S. or S.W. border, should be selected, and the drills drawn ten inches apart. The ground for these early sowings should be prepared in advance, and if of a heavy nature plenty of suitable material to lighten the staple and render it more porous should be added; but manure should be omitted.

The main crop of carrots which provides for winter and early spring use is oftentimes one of the most difficult crops that the gardener has to grow, and in many gardens the results obtained are anything but entirely satisfactory. The site selected should be an open and sunny one, and the ground deeply worked, but no manure should be applied. The surface should be turned over in as rough a condition as possible and left to the influence of the weather, so that when the time for seed sowing arrives, and during suitable weather, a good tilth may be obtained. On soil that is not naturally suited for carrots, and that is destitute of lime, a good coating of lime should be given when it is turned up, as well as a liberal addition of burnt earth, wood-ash, &c.

During favourable weather in April the rough surface should be broken down with a fork as finely as possible, and on retentive soil it is advisable to throw out an alley on either side of the bed. The bed should then be raked over with a wooden rake and made as level as possible, when the position the rows are to occupy may be marked out at either end of the bed by means of sticks. Then, stretching a garden line tightly across, drills may be drawn twelve to fifteen inches apart, and the seed sown evenly and thinly. The bed should be raked over with an iron rake after sowing is completed, leaving the surface free from any rough stones or other material. The seedlings should be thinned as soon as they can be handled, *i.e.*, when about one inch high, and the thinnings carefully collected into baskets or pails and burnt.

The plants should be left from six to eight inches apart when thinned.

When the seedlings are large enough, the space between the rows should be frequently loosened with the Dutch hoe, both to keep down weed growth and to conserve the moisture in the ground by providing a natural mulch. During showery weather, and quite early in the morning, nothing will be more beneficial than an application of soot between the drills. When the crop is growing freely, and during damp weather, dustings of artificial manure between the drills will prove equally valuable.

In heavy soils that are quite unsuited to the cultivation of good carrots, and where good specimens are required, the best method to adopt is the following. The soil should be deeply worked, and in the spring, when possible to work comfortably, holes may be bored with an iron bar at a distance of nine inches to a foot apart. The holes should be nearly three feet deep and filled with finely sifted, light, sandy soil, such as old potting material passed through a fine sieve, with some wood ashes and bone meal added. Care should be taken that this prepared soil is kept under cover, and that it reaches the base of the hole; and the workman should have a thin stick to help work it down and firm it. A pinch of seed should then be sown at each spot and be lightly covered over. The final thinning should leave the most promising plant as near to the centre of the hole as possible. Subsequent treatment will be much the same as for the main crop, and if unusually dry weather sets in, the surface between the plants may be mulched with some spent mushroom-bed manure, leaf-mould, or other suitable material, which will do much to prevent the ground from cracking and the crown of the roots from becoming green. As soon as the roots are of sufficient size, and when the weather is favourable, the whole of the main crop should be lifted and stored in a convenient and suitable manner for winter supplies. The carrots should be lifted with a fork and the tops trimmed off close to the crown, and any that are badly damaged or deformed should be placed by themselves. The best-shaped roots are best stacked, when quite dry, in a cool root-shed, with a little fine soil worked in between them; in

this state they will keep almost indefinitely, but failing a cool shed, they may be stored out of doors under a wall or shielded from cold and heavy rain.

For very early supplies, Inimitable and Long Forcing mature quickly, followed by Favourite, whilst for main crops, New Red Intermediate and Scarlet Intermediate are each to be recommended for general culture, as is also Improved Long Red Surrey where an ideal carrot soil exists.

The principal pests of carrots are the wireworm (Leaflet No. 10) and the carrot-fly (Leaflet No. 38), both of which are extremely troublesome in some localities.

IMPORTS OF GRAIN IN THE CEREAL YEAR 1912—13.

THE extent to which this country has been dependent on the Colonies and foreign countries for grain to supplement the harvest of 1912 may conveniently be considered at the end of the cereal year (September 1st to August 31st).

The imports of wheat into the United Kingdom amounted to 26,500,565 qr. (of 480 lb.), these being greater by 2,391,000 qr. than the imports of 1911–12, and by 2,984,000 qr. than the imports of 1910–11. Including the produce of the home wheat crop of 1912, and converting the imported flour into an equivalent quantity of wheat, the total quantity of wheat available for consumption in the United Kingdom was 37,324,750 qr., compared with 35,472,600 qr. in 1911–12 and 33,854,000 qr. in 1910–11. In these amounts seed is included, but not stocks carried over. Similar figures for recent years are given in the following table:—

Harvest Year	Wheat Crop of the United Kingdom	Imports of Wheat during the Cereal Year Sept 1–Aug 31	Imports of Wheat Flour in equivalent Weight of Grain	Total Imported Wheat and Flour in equivalent Weight of Grain	Total estimated Wheat Grain available for home consumption (including seed)
	Qr	Qr	Qr	Qr	Qr
1903–4	6,102,300	21,723,820	6,203,350	27,927,170	34,029,470
1904–5	4,740,000	24,529,170	3,526,620	28,055,790	32,795,790
1905–6	7,541,600	22,063,580	4,677,330	26,740,910	34,282,510
1906–7	7,577,300	22,105,180	4,284,490	26,389,670	33,966,970
1907–8	7,066,400	21,362,720	4,339,090	25,701,810	32,768,210
1908–9	6,741,200	21,727,220	3,554,650	25,281,870	32,023,070
1909–10	7,899,600	24,099,060	3,501,520	27,600,580	35,500,180
1910–11	7,074,200	23,516,140	3,263,380	26,779,520	33,853,720
1911–12	8,039,200	24,109,260	3,324,140	27,433,400	35,472,600
1912–13	7,175,300	26,500,565	3,648,883	30,149,450	37,324,750

With regard to the countries from which the supply of wheat was drawn, the receipts from each of the principal sources of imported wheat are given below:—

Country of Export.	Thousands of cwt			
	1912-13	1911-12	1910-11.	1909-10.
India ..	23,152	21,468	21,460	16,077
Russia ..	7,379	8,52c	25,728	27,911
Argentina ..	18,617	16,823	16,983	11,405
United States ...	31,569	16,619	9,479	14,911
Canada ..	21,249	19,819	13,826	18,539
Australia ..	9,738	15,170	10,418	11,915

The feature of the cereal year's trade in wheat was the large increase in the imports from the United States, viz., from 16,619,000 cwt. in 1911–12 to 31,569,000 cwt. in 1912–13. For four years prior to 1910–11 there was a continuous decrease in the imports from that country, but the supplies in the last two years have very largely increased, and the imports in the cereal year 1912–13 were the highest since 1902–3 (32,035,000 cwt.). The imports from Canada, 21,249,000 cwt., are the largest yet recorded from that country; there was a fall, on the other hand, in the imports from Australia, the quantity sent being less than in the three preceding years. Increased supplies during the year came from India and Argentina; there was a slight decrease in the imports from Russia. A factor of increasing importance in recent years in the wheat trade has been the imports from south-eastern Europe; the imports from Turkey and Roumania were 1,431,000 cwt. in 1910–11 and 2,763,000 cwt. in 1911–12; in 1912–13, however, they dropped to the unimportant figure of 107,000 cwt.

The price of home-grown wheat fell during the year, while there was a slight rise in the price of imported wheat, viz., from 35*s.* 11*d.* per qr. in 1911–12 to 36*s.* 2*d.* in 1912–13. The average declared value of imported wheat in previous years was 33*s.* 10*d.* in 1910–11, 37*s.* 5*d.* in 1909–10, and 39*s.* 1*d.* in 1908–9. English wheat averaged 32*s.* 0*d.* per qr., a fall in price of 2*s.* 10*d.* per qr. compared with 1911–12. There was in general a fall in the price of English wheat between September, 1912, and January, 1913, and a rise in

price between January and August, 1913. English barley averaged 27*s.* 10*d.* per qr. (a fall of 3*s.* 4*d.* compared with the preceding year), while English oats averaged 19*s.* 7*d.* (a fall of 1*s.* 11*d.*). The value of imported barley was 27*s.* 11½*d.* per qr., and of imported oats 18*s.* 3*d.* per qr.

The following table shows the average prices of English wheat, barley, and oats ascertained under the Corn Returns Act in each of the cereal years since 1901. The quantities given in the table are the quantities returned as sold, from which the averages are calculated:—

Harvest years.	Prices per quarter.			Quantities sold at certain markets.		
Sept 1–Aug. 31	Wheat	Barley	Oats	Wheat	Barley.	Oats.
	s *d.*	*s* *d*	*s.* *d.*	Quarters	Quarters.	Quarters.
1901–02	28 4	25 11	20 4	2,451,275	3,176,599	698,840
1902–03	26 5	23 4	17 8	2,386,017	3,151,337	1,104,660
1903–04	27 2	21 10	16 4	2,129,448	2,780,473	1,132,086
1904–05	30 7	24 6	17 0	1,746,927	3,141,058	1,178,154
1905–06 ..	28 9	24 2	18 5	2,940,263	3,202,613	940,015
1906–07	28 1	24 5	18 4	2,830,991	3,376,615	1,219,419
1907–08 ...	32 9	25 8	18 2	2,944,256	3,564,908	1,530,848
1908–09	36 6	26 11	18 10	2,962,825	2,972,889	1,054,318
1909–10 .	32 6	23 10	17 8	3,144,873	2,988,483	795,824
1910–11 ...	30 11	24 9	17 8	2,799,763	2,992,128	831,898
1911–12	34 10	31 2	21 6	2,944,995	2,645,477	719,495
1912–13 ...	32 0	27 10	19 7	2,324,474	2,489,932	630,276

The aggregate imports of the principal cereals in each of the past nine years are given below:—

Harvest year	Millions of cwt				
	Wheat	Wheat Meal and Flour	Barley	Oats	Maize
1904–5	105 1	10·9	21 0	17 2	42 3
1905–6	94 6	14 4	20 3	16·0	47 1
1906–7	94 7	13 2	19 5	10·9	51 7
1907–8	91 6	13 4	17 5	13 2	39 5
1908–9 .	93 1	11 0	22·0	15 5	39 0
1909–10	103·3	10 8	19·9	19·6	34 6
1910–11	100 8	10 1	20·1	16 6	46 0
1911–12 .. .	103·3	10 3	21 9	18·4	32·1
1912–13	113 6	11 3	22 4	20 0	49·5

There was some increase in 1912–13 in the imports of flour, which had, on the whole, been declining since 1901, when 23,000,000 cwt. were imported. The imports are principally from the United States and Canada; the supplies

from Canada (3,850,000 cwt.) were slightly below those of last year (3,945,000 cwt.), while those from the United States increased from 4,419,000 cwt. in 1911–12 to 5,583,000 cwt. in 1912–13. There were larger quantities, both of barley and oats, imported in 1912–13, the imports being the highest since 1903–4 in the case of barley and 1900–1 in the case of oats.

THE WOOD PIGEON.

R. STEWART MACDOUGALL, M.A., D.Sc.

THE Wood Pigeon (*Columba palambus*) is the largest member of the Pigeon family in Europe; it is also known as the Ringdove, the Cushat, the Cushie-Doo, and the Queest. It measures 16½ to 17 inches from the head to the end of the tail, while the spread of wings is from 28 to 30 inches.

The head, the upper part of the neck, the back and the upper part of the tail are blue-grey with a shimmer of green and purple. A partial ring of white round the neck is the reason for the name Ringdove. The young birds have not this white ring on the neck. The breast is purplish-red. Further back the under-surface is grey or ash-grey. The wings are long, and when spread in flight a conspicuous and characteristic bar of white shows across them. The long tail has twelve broad feathers, greyish in colour. The legs are dark pink or reddish. There is little or no sexual colour distinction, the females being only a little less showy. The flight of the Wood Pigeon is rapid, and when flushed the bird rises with a loud flapping of the wings.

The Stock Dove (*Columba aenas*) is not so common as the Wood Pigeon, but has somewhat similarly troublesome habits. The mature bird can be distinguished from the Wood Pigeon by its smaller size, its darker blue-grey plumage, and the absence of the white ring on the neck, and while in flight it shows no white bars on the wings.

The Wood Pigeon makes, in trees, a frail and loosely constructed nest of twigs, with the addition of a few roots. The winter flocks break up for nesting early in spring. Two eggs are laid, and these are glossy white in colour. The

male bird takes a share in sitting. The eggs hatch in seventeen days. At the time of hatching the young are blind and helpless; they cannot digest hard food, and therefore for a time they are fed on a whitish, curd-like secretion from the crop of the parent—the so-called "pigeon's milk."

There may be three broods in the year; the first young birds are seen in May, the next brood appears in July, and a third in autumn.

The Wood Pigeon is generally distributed over the wooded districts of Britain, and may be described as a resident species, though in the north all birds may disappear in severe weather. In winter the Wood Pigeons collect in flocks. The resident population may be largely added to, especially on the east side of Britain, by great numbers of Wood Pigeons from the Continent, these birds arriving in autumn and early winter.

Typically the Wood Pigeon is shy and retiring, and distrustful of man, but both on the Continent and at home it can be found nesting in large cities. A good example of this is in Hyde Park and other places in London, where the Wood Pigeons come even to hand to feed.

By common consent the Wood Pigeon is one of the farmer's chief enemies. The contents of the crops and stomachs of Wood Pigeons shot during a whole year differ somewhat, according to the season and the type of agriculture of the district. The bird, however, makes wholesale levy on the products of the fields, and in some degree on those of the woods.

Following in a general way over the year and beginning with autumn, the Wood Pigeon takes quantities of grain—wheat, oats, barley, rye—beans, beechmast, acorns, haws, holly berries, cabbages (sometimes a crop is ruined in winter), turnips (the tops are eaten and the bulbs are "holed"), swedes, the buds of trees, potatoes, the leaves of clover, sown grain, sprouting grain, the leaves of young cereals, tree seeds, young turnips, vetches, peas, beet, lettuce, cherries, currants and gooseberries. Weeds and their seeds are also taken, *e.g.*, charlock, runch, goosegrass, spurrey, chickweed and dock.

The Wood Pigeon feeds greedily and has a large crop. Archibald took from one 1,100 grains of corn and 40 peas

Gilmour and McAlpine from one bird took 53 beans, and from another 2 ounces of barley grains. Nelson, quoting a correspondent of *The Field*, records from single birds 73 hazel nuts (January), 838 grains of corn (October), a cupful of turnip tops (December), 76 acorns and a quantity of swede tops (December).

Fighting the Wood Pigeon is rendered difficult by the bird's wariness and distrust of man.

1. Boys are employed to scare them from newly sown fields and from young crops.

2. *Shooting.*—A good time for this is at sunset and before dusk, when the birds are coming to roost in the plantations. The birds fly head to wind. The likelihood of success is greater if the shooter be in some prepared sheltered place, *e.g.*, "a conical hut of branches built at the foot of a tree."

The birds may also be shot at their feeding places, preferably from some shelter.

The use of decoys is strongly recommended. These may be stuffed birds placed on branches of trees, or newly-killed birds in cases where the shooter is lying in wait at some feeding-place in stubble or turnip field.

Speedy records success by this method:—"An extemporised place of shelter is made at the side of a field where the wood pigeons are feeding. A few decoys are placed within range of the hiding-place. A dead bird with its head propped up by a bit of stick constitutes an excellent decoy. Despite the wariness of these birds, it is surprising how indifferent they are to the report of a gun so long as the shooter keeps out of sight. I have killed scores in a day in this way. At each shot every live bird flew off, and for a minute or two none were to be seen. Presently one would fly over at a high altitude, then, in gradually lowering circles, would settle among the decoys despite the fact of dead companions lying all around. The lowering aerial circles were evidently the means of attracting others, as immediately they could be seen coming in all directions and settling."

Horace Hutchinson writes:—"The most effective way that a man working by himself can follow is to build a 'hide' in a hedge beside a field which the birds frequent. Encourage them to make it their feeding-place by laying out peas and

1.

APPLE LEAF-SPOT.

(*Sphæropsis malorum*, Peck.)

FIG. 1.—Showing stages of growth of the leaf-spot fungus on apple leaves. Nat. size.
,, 2.—Section of perithecium. × 60.
,, 3.—Spores. × 400.
,, 4.—Early stage on a young branch.

beans for them within gunshot of the hide. Procure a tame pigeon and fit it with a harness in the form of a belt under its wings, and attach to the belt, from above, a long end which shall pass over a raised crossbar. Set up a foot or two in height, at the spot where you want your wild pigeons to come down and feed, and lead the end of the cord to your 'hide.' When you pull the cord you lift the pigeon off the ground, and he opens his wings and flies in a way that attracts the notice of the birds flying overhead, and disposes them to come down and feed."

In districts where Wood Pigeons are numerous, shooting parties might usefully be organised at a convenient season.

Wood Pigeons make good eating. They sell in shops at 10*d.* each in March and April, and at 1*s.* when game is out of season.

3. *Trapping.*—An excellent trap is the cage-trap used by keepers for catching up pheasants to put in the pens.

The trap may also be a large wire cage, provided with doors that fall easily. This cage should be left till the birds get accustomed to it, grain to attract them having several times been spread at the open doors and inside. Later a watcher from some place of concealment pulls a wire which makes the doors fall, thus imprisoning any feeding birds.

Apple Leaf spot.

THIS disease (*Sphaeropsis malorum,* Peck), is the cause of serious injury to the apple, pear and quince in the United States, where it has been recognised for a considerable time. It has only recently been reported as occurring in this country, although in all probability it has always been present, and has been passed over as being one of the other better-known fungi attacking our fruit-trees.

The trunk, branches, leaves and fruit are attacked. On the trunk and branches the fungus causes a roughening of the bark, either as local patches, or extending for a considerable distance, destroying the bark and exposing the wood. When a branch is girdled, the portion above the wound dies. It also occurs on slender twigs.

The fungus causes a brown rot of the fruit, commencing as a small spot which usually spreads over the

whole fruit. The fruit may be attacked while on the tree, but the fungus is most abundant on fallen fruit, where it produces spores in great abundance, which infect the tree the following season. In this country it has so far only been observed on apple and pear, more especially the former, and is most frequent on the leaves and young branches.

On the leaves the first indication of infection is the presence of minute, dark purple spots, which gradually increase in size, usually retaining a more or less circular outline, reaching up to half-an-inch in diameter. Very frequently neighbouring spots coalesce, forming irregularly shaped blotches. When old, the blotches are rusty-brown in colour, the central portion often being of a lead colour. Usually only after infected leaves have been lying on the ground for some time, very minute black points, the fruit of the fungus, are scattered over the central portion of the patches. Leaves that are infected fall early in the season, and if this defoliation is continued each season, as is almost certain to be the case unless preventive measures are taken, the trees become injured, and the fruit small and poor in quality. No very large canker wounds have been observed in this country, but young twigs are attacked, the infected areas being indicated by the bark becoming dry and much cracked, and the epidermis or skin being lifted up and torn into shreds. On such diseased areas the perithecia, or fruit of the fungus, can be seen during the winter months, and it is mainly due to the spores produced on dead twigs that the leaves become infected in the spring. Scott and Rorer, who have investigated this disease in the United States, say that it occurs abundantly on dead twigs and branches in nearly every orchard, producing spores in enormous numbers. This is perhaps the most fertile source of infection for both fruit and foliage. In old orchards, particularly where pruning is neglected, the leaf-spot disease is much worse than in young orchards. The leaves of young trees adjacent to an old orchard become more spotted with the disease than those further removed.

These observations clearly indicate that the prompt removal of dead branches and shoots is a matter of primary importance in checking the disease. The fallen diseased fruit should also be collected and destroyed. It is not at all certain that

the spores on diseased fruit eaten by pigs or other animals are killed. Numerous spores are also produced on fallen, diseased leaves, a fact that it is well to remember, although it has been stated that the collection of such leaves is impracticable.

However carefully the trees may have been pruned, and fallen diseased material destroyed, many spores are certain to remain on and around the trees. To prevent these from infecting the young leaves the trees should be sprayed with Bordeaux mixture, half strength. A first spraying should be made about a week after the petals have fallen, and a second about a month later. Self-boiled lime-sulphur wash may be used for spraying instead of Bordeaux mixture.

The perithecia are immersed in the substance of the matrix, the minute mouth or opening through which the spores escape just rupturing the epidermis of the leaf, and showing as a black point on the surface. The spores are elliptical, dark coloured, and average $25 \times 12\mu$.

The blotches formed on apple and pear leaves by the scab fungus, *Venturia inæqualis*, Aderh. (=*Fusicladium dendriticum*, Fckl.), are readily distinguished from those due to the fungus under consideration, by the ill-defined blotches being blackish or olive in colour, and by the spores not being produced in perithecia. A description of Apple Scab, together with remedial measures, are given in Leaflet No. 131.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURING.

The Partial Sterilisation of the Soil by means of Caustic Lime (*Journ. of Agric. Sci., Vol. v., Part iii., June,* 1913; *H. B. Hutchinson, Rothamsted Expt. Sta.*).—Caustic lime is generally recognised as a material capable of increasing the crop-producing power of the soil. Its action, however, is very complex and but imperfectly understood. In this communication an account is given of experiments designed with a view to supply information calculated to account for such results as are frequently obtained in practice. Equal portions of a poor, unmanured soil containing 3 per cent. calcium carbonate were filled into bottles. One portion served as control and the others received 0·1, 0·5, and 1 per cent. calcium

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

oxide respectively. The water content in each case was brought up to about 18 per cent., and the bottles were kept at room temperature. Quantitative analyses for bacteria, ammonia, and nitrates were made, and small portions of soil were tested for the presence of protozoa. Somewhat similar experiments were carried out with a rich garden soil, an acid soil from the Woburn Experiment Station, and also in pot cultures. The author draws the following conclusions:—

The physical condition of a soil is improved by lime either in the caustic or mild form. By liberating nutrient substances and neutralising acids, lime favours the development of soil organisms. Caustic lime is a valuable antiseptic, and when applied to the soil, even in the presence of large quantities of calcium carbonate, it disturbs, or destroys, the state of equilibrium normally existing between the micro-flora and micro-fauna of the soil.

In addition to killing many bacteria, it destroys the larger protozoa which seem to exert a depressive effect on bacterial growth, and brings about a decomposition of organic nitrogenous constituents of the soil. It is highly probable that these decomposition products serve as nutrients for bacteria and are subsequently resolved into plant food.

The inhibitory action of caustic lime on soil bacteria varies with the soil, is possibly governed by the organic matter present, and seems to persist until all the oxide has been converted into carbonate; this is followed by a period of active bacterial growth and increased production of plant food. In the pot experiments it was found that while the poor arable soil, containing a sufficiency of calcium carbonate, gave increased yields when treated with 0.5 per cent. calcium oxide, the rich garden soil gave decreased yields in the first crop, but largely increased yields in the second crop.

Water-Soluble Matter in Soils Sterilised and Re-inoculated (*Cornell University Agric. Expt. Sta., Bull. No.* 326).—Three different soils, viz (1) heavy clay loam, (2) silt loam, (3) a mixture of clay loam and decomposed grass turf, were sterilised by steam. In each case one portion of the steamed soil was left untreated, while the other two portions were inoculated with fresh soil and heated soil respectively. A gradual decrease in water-soluble matter took place on standing. This was most marked for several weeks in the soil inoculated with fresh soil, but at the end of six months this soil contained the largest amount of water-soluble matter. At first wheat and millet plants made most growth on this soil, but their yield at harvest was less than that from plants growing in the uninoculated soil It was observed that in any soil there was greater luxuriance of growth when the rate of disappearance of soluble matter increased Evidence was obtained which indicated that toxic matter was the controlling factor in the productivity of steamed soils and that the nature of this matter was different in soils (1) and (2). The rapidity of oxidation in the soil as measured by the oxygen requirement did not always indicate the rate at which toxicity disappeared.

FIELD CROPS

Report of the Home-Grown Wheat Committee for the Seasons 1910–11 and 1911–12.—The Home-Grown Wheat Committee was established in

October, 1901, and has been continuously at work during the intervening eleven seasons. It has done much work with a view to improve both the quality and yield of wheat grown in this country. In previous reports issued by the Committee it has been shown that because a few varieties of wheat possess a certain quality of endosperm, they are specially well suited for bread-making purposes, and that this desirable quality is inherent to those varieties. This desirable quality of endosperm is a separate Mendelian unit and can therefore be transmitted from an otherwise undesirable parent to an otherwise highly desirable child. The quality of wheat is not appreciably improved by manuring, rotation of crops, or early cutting. Autumn-sown wheat is as "strong" as spring wheat when grown under conditions as nearly as possible identical. Immunity to rust, which is a Mendelian unit, found in or conferred on a variety, greatly increases its yield of grain and straw and indirectly improves the quality of both. A great number of wheats have been grown, but only a few, including Red Fife and White Fife, were considered worth testing on an extensive scale.

Red Fife, when sown at the rate of 2 bushels per acre, though possessing marked tillering power, appears to be very "thin on the ground." Seedings of 3 and 4 bushels per acre gave increases in yield of 5½ and 10 bushels per acre respectively. Thick seeding produced thinner stems, and increased the proportion of small and sterile ears, but lessened the amount of rust. Red Fife is essentially a "light land" wheat and should not be sown on cold, wet soils. Its great value in the opinion of the Committee is its ability to maintain continuously the high quality of endosperm. On a farm in Kent, when sown on April 19th, at the rate of 3½ bushels per acre, and top-dressed with nitrate of soda at the rate of 1¼ cwt. per acre, it produced 49 bushels of grain and 50 cwt. of straw per acre.

White Fife is interesting (1) because it furnishes an excellent example of the facts that a white wheat can be exceedingly "strong," that it need not be particularly liable to "sprouting" in wet seasons, and that it may possess good milling qualities, and (2) because it is yielding progeny which will go to swell the rapidly accumulating large number of varieties from which it will be possible to choose several possessing qualities demanded by both growers and millers.

Little Joss is a variety produced by Professor Biffen, of Cambridge, from a cross between a Russian wheat and "Square Head's Master." It was sent out by the Agricultural Department of Cambridge University not as a variety designed to satisfy the requirements of millers, but with the purpose of providing a variety which should be resistant to rust.

Burgoyne's Fife was produced by Professor Biffen from a cross between a Fife wheat and Essex Rough Chaff, and possessed sufficiently good points to warrant its distribution on a large scale. The Committee has reason to believe that this variety is approved by a large number of growers, and is likely to remain in cultivation as an autumn-sown and spring-sown wheat, at any rate till its sisters or relations are ready to take its place. It is an excellent milling wheat, and when mixed with ordinary English wheat it materially improves the quality of the resulting flour.

Wheat Breeding.—This part of the Committee's work has been in the hands of Professor Biffen, and during the last two seasons special

attention has been directed to selecting and fixing new types of wheat from crosses between either Red or White Fife and such heavy-yielding kinds as Square Head's Master, Browick, and Rivett. Over two hundred originally chosen for cropping capacity, good straw, and strength have been satisfactorily fixed. Each variety was grown in 1911 on duplicate plots widely separated from one another on the experimental field. The plots were uniform in size and consisted of twelve four-foot rows with grains planted at two-inch intervals. The best types were selected and grown in the following year on duplicate plots one-fortieth of an acre in size.

It is very important that the cropping capacity of the different varieties be known before wholesale propagation is commenced, and extensive experiments are now in progress with the object of finding out reliable methods for ascertaining this important character. It has been found in some cases that attacks of rust have been far less serious when small dressings of various chemicals have been applied to the growing crop, and experiments calculated to throw further light on the subject are in progress.

A small number of promising Fife crosses are being grown in plots of three or four acres each, and a much larger number are being tested for yielding capacity, &c., on plots up to one-fortieth of an acre in extent. The wheat-breeding investigations have been transferred to the newly founded Institute of Plant-Breeding, which receives a grant from the Board of Agriculture, and is under the control of the School of Agriculture at Cambridge, and the experiments are now being carried on under much better conditions.

LIVE STOCK AND FEEDING STUFFS.

Report on Calf-Feeding Experiments with Separated Milk and Oils (*North of Scotland Coll. of Agric., Bull. No.* 17; *James Hendrick, B.Sc., F.I.C.*)—These experiments were carried out in order to demonstrate (1) that calves fed on separated milk and butter-fat substitutes will grow up quite healthy and will produce good beasts for the butcher; (2) that taking whole milk and separated milk at fair commercial prices, and allowing for the cost of substitutes for butter-fat, it is economical to bring up commercial stock on separated milk and substitutes. Experiments have shown that where suitable substitutes such as cod-liver oil have been used to replace the butter-fat, there has not been much difference between the calves reared on whole milk and those reared on separated milk and substitutes, and that in the case of commercial stock reared according to the latter system any loss of value in the calves has been more than compensated for by the value of the butter-fat, provided it has been made into butter of good quality. A further object of the experiments being to ascertain whether some other oil would not give as good results as cod-liver oil, cotton-seed oil was compared with the latter.

Series	I.	consisted of 18 calves and the experiments, started in the spring of 1908.
Series	II.	,, 11 ,, ,, ,, ,, at the end of 1908
Series	III.	,, 15 ,, ,, ,, ,, in the spring of 1909.

On the average the whole milk feeding period previous to the commencement of the experiment was four weeks. The calves of each

series were then divided into three lots and put on the experimental rations. The following table gives the daily experimental food per calf in Series III.:—

LOT I.—WHOLE MILK.

1st four weeks of experiment . .	1 gallon whole milk
2nd, 3rd, and 4th four weeks of experiment	1¼ ,, ,, ,,
5th four weeks of experiment	1 ,, ,, ,,

LOT II.—COD-LIVER OIL.

	Whole Milk	Separated Milk	Cod Liver Oil	Meal.
1st week of experiment	⅔ gall.	⅓ gall.	—	2 oz
2nd ,, ,, . . .	⅓ ,,	⅔ ,,	—	4 ,,
3rd and 4th weeks of experiment			1 fluid oz.	4
2nd four weeks of experiment			2 ,,	6
3rd ,, ,, ,,			2½ ,,	6
4th ,, ,, ,,			3 ,,	6
5th ,, , ,,			3 ,,	4

LOT III.—COTTON-SEED OIL.

Same as Lot II, except that cotton-seed oil was used instead of cod-liver oil

The calves got milk three times daily. The meal consisted of two parts of whole linseed finely ground, one part of fine oatmeal, and one part of wheat-meal, and cost 16*s.* per cwt. The prices of cod-liver oil and cotton-seed oil were 3*s.* 6*d.* and 2*s.* 6*d.* per gallon respectively. Whole milk was valued at 6*d.* per gallon and separated milk at 1*d.* per gallon, those prices being considered fair on an ordinary farm not favourably situated for the sale of these commodities. After weaning, the animals in each series were all treated alike and sold to the butcher when about two years old, when their live and dead weights were ascertained. In the following table a summary of the results of the whole experiment is given :—

	LOT I Whole Milk	LOT II Cod Liver Oil	LOT III Cotton-seed Oil
Total number of calves ...	14	15	15
Average weight at start	109 lb	113 lb	107 lb.
Average weight at weaning	316 ,,	297 ,,	284 ,,
Average increase when weaned ...	207 ,,	184 ,,	177 ,,
Average cost to time of weaning... ...	£4 2*s.* 3*d*	£1 8*s* 0*d*	£1 7*s.* 3*d.*
Average cost per lb of increase	4·77*d*	1·83*d*	1·85*d*
Number of animals sent to butcher	12	15	14
Average weight at start of those sent to butcher	110 lb.	113 lb	103 lb.
Average weight when sent to butcher .	1148 ,,	1118 ,,	1079 ,,
Average increase from start till sent to butcher . . .	1038 ,,	1005 ,,	976 ,,
Average increase from weaning till sent to butcher	832 ,,	821 ,,	795 ,,
Average carcass weight	651 ,,	631 ,,	609 ,,
Average price per cwt. dead weight	65*s.* 9*d.*	65*s.* 6*d.*	65*s.* 6*d*

It is concluded that, placing a fair valuation upon whole and separated milk, calves can be fed on separated milk, oil, and meal gruel at a much less cost per pound of increase than on whole milk. Even if 3*d.* per gallon can be obtained for separated milk, there still remains a large balance in favour of feeding with separated milk and oil. Cotton-seed oil may be fed to calves as a substitute for the fat of milk

in quantities up to 3 oz. per calf per day, and gives almost as good results as cod-liver oil at a slightly lower cost. The animals reared on separated milk and butter-fat substitutes did almost as well subsequently and produced as good carcasses as those reared on whole milk.

Potatoes as a Food for Pigs (*Journal für Landwirtschaft, Heft. iii.,* 1913).—These experiments were designed to test the value of potatoes as compared with maize as the principal food in the rations fed to pigs. The basal ration was fixed and the animals given as much potatoes and maize as they would eat. The 43 pigs used were of the improved German breed, about 44 lb. in weight and 12 weeks old, the object being to fatten them to a slaughter weight of about 240 lb. in five months.

The amounts of food consumed, the increases in live weight, and the profit in 22 weeks will be seen from the following table:—

	Lot 1 (11 pigs) average per pig.	Lot 2 (11 pigs) average per pig.	Lot 3 (11 pigs) average per pig	Lot 4 (10 pigs) average per pig.
Foods consumed.—	lb	lb	lb	lb
Fishmeal	25½	25½	25½	25½
Gram	335	335	335	335
Rye Chaff	—	—	10½	80
Meatmeal	—	—	—	19
Maize	377	—	—	—
Potatoes	—	1,479	1,581	1,389
Increase in live weight	187	168	188	189
Profit (i.e. value of increase less cost of food consumed)	27*s*. 11*d*	24*s* 1*d*	31*s* 3*d*	32*s*

The value of the increased live weight was reckoned at 5·4*d*. per lb., and the costs of the foods as follows (per lb.)—Maize, 0·9*d*; gram, 1*d*.; fishmeal, 1·4*d*; meatmeal, 1·7*d*.; rye chaff, 0·1*d*; and potatoes, 0·18*d*.

DAIRYING.

Studies in Milk Records: The Influence of Fœtal Growth on Yield (*Journ. of Agric. Sci., Vol. v., Part iii., June,* 1913; *William Gavin, B.A., Lord Rayleigh's Dairy Farms, Terling, Essex*).—In a previous paper on the "Interpretation of Milk Records," the author dealt with the selection of a figure definitive of a cow's milking capacity and the influences affecting such a figure. The figure chosen as being most satisfactory was the maximum day-yield three times reached or exceeded, and was termed the "Revised Maximum." This figure was stated as being outside the influence of (*a*) length of lactation period and (*b*) time of service of the cow. The present paper gives the result of further work calculated to prove the statement regarding time of service. From the examination of 1,421 records, it was found that 84 per cent. of the total number of cows reached their maximum day-yield by the 8th week after calving, 92 per cent. by the 12th week, and 97 per cent. by the 16th week. In the case of January calvers 72 per cent. gave a maximum before the 12th week and 97 per cent.

by the 20th week, while cows calving in February show corresponding figures of 74 per cent. for the 12th week, and 100 per cent. for the 20th. In no case did fœtal growth reduce the yield sooner than 12–16 weeks after service. Since 12 weeks at the very least (and probably 16–20 weeks) must elapse between *service* and any fall in yield due to fœtal development, and since 97 per cent. of the cows were found to have reached their maximum day-yield within 16 weeks of *calving* and 99 per cent. within 20 weeks, the chances of the "Revised Maximum" being affected by time of service are very slight. It was observed that once reduction in yield began the rate of fall due to fœtal development was very similar to that found where there was no gestation.

Increase in the Specific Gravity of Freshly-Drawn Milk (*Journal fur Landwirtschaft, Heft. iii.*, 1913).—The increase in the specific gravity or so-called "thickening" of milk, which takes place in the first few hours after milking and at temperatures under the melting point of the milk fat, was first noticed by a French experimenter, Quévenne, about 1841. The present experiments were undertaken to discover the cause of this phenomenon. It was found only to occur at temperatures at which the milk fat can become firm and to be undoubtedly due to progressive coagulation of the milk fat, which is liquid at the time of milking. All other explanations were found to be untenable.

It was shown that the thickening did not take place when the milk was prevented from cooling at temperatures at which fat can coagulate, and it was not discernible in separated milk from which the cream had been quickly skimmed, so that the fat content was very small.

An increase in specific gravity was obtained under the requisite conditions with emulsions made from milk fat and water, while the phenomenon was not noticed with emulsions of oils which remain liquid at the temperatures in question.

It was evident, by using the polarisation microscope, that the fat in the milk does coagulate in cooling, and the coagulated part has a higher specific gravity than the liquid part. It is well-known that pure milk fat in large quantities changes its state of aggregation at 19° to 24° C., and it is probable that at ordinary temperatures, 12° to 20° C., milk fat coagulates, both in emulsions and in milk.

This increase in the specific gravity of freshly-drawn milk begins with the cooling under the melting point of the milk fat and lasts from four to six hours. Thereafter the specific gravity of the milk no longer changes at any given temperature. Although it is not probable that *all* the fat coagulates during this period, the great proportion must do so, otherwise milk, in which the increased specific gravity had reached its limit at average temperatures, would thicken further if exposed to low temperatures for a further period, which, according to these experiments it does not do.

HORTICULTURE.

Treatment of Apple Trees (*Harper Adams Agric. Coll., Report on Field Expts.*, 1912).—In 1902 an experiment was commenced for the purpose of demonstrating (*a*) the effect of pruning, and (*b*) the effect of grass round apple trees. Eight standard trees of each of the following varieties, which vary considerably in growth, were chosen:—Cox's

Orange Pippin, Bramley's Seedling, and Bismarck. The trees were planted in March in four rows, two trees of each variety in a row, the distance between the rows and trees being 20 ft. Three of the rows were on ground regularly cropped with vegetables, while the fourth row was on ground sown with a grass mixture in 1900. Of these one row on the vegetable ground was neither pruned nor sprayed; the other two rows, as well as the row on grass, were pruned and sprayed regularly. From January, 1905, the diameter of all the trees was measured at 4½ ft. from the ground, and it was found that the rate of increase was generally greater in the pruned trees. The growth of the unpruned trees was irregular and the heads badly formed, while the pruned trees were well shaped and well furnished with buds.

In the following table is given the average annual increase in diameter (inches) made in eight years by the three varieties of trees growing on grass and cultivated land:—

Cox's Orange Pippin		Bramley's Seedling		Bismarck	
On grass	On cultivated ground	On grass	On cultivated ground	On grass	On cultivated ground
0 14	0 31	0 23	0 47	0 18	0 30

It will be seen that the average increase in growth was about twice as great in the trees on the cultivated land as in those on grass. The pruning of the trees on grass was difficult, as the amount of wood produced was very meagre. Frequently buds refused to start, and consequently the heads became irregular and badly balanced

The fruit of the trees on grass was decidedly deeper in colour but much smaller, while the average yearly crop per tree during the four years, 1909–12, was as follows:—

	Cox's Orange Pippin	Bramley's Seedling	Bismarck
	lb	lb	lb
Trees on grass	1¼	5	6
Trees on cultivated ground	20½	37½	31

In January, 1907, a space of four square yards was cleared round the stems of alternate trees on grass and kept free from weeds This resulted in a rapid improvement in the heads of the trees and more vigorous growth.

Manuring of an Apple Orchard (*New York Agric. Expt. Sta., Bulls.* 289 and 339, *and Annual Report of the Board of Control*, 1909; *U. P. Hedrick, Bull. of Agric. Intell., Jan.*, 1913).—With the hope of throwing some light on orchard fertilisation, several experiments were con-

ducted to show the effects of potash, superphosphate, and lime on apple trees.

The soil chosen for experiment was a heavy clay loam, and had been used for the ordinary rotation of farm crops. There were 12 plots, each containing five trees, and separated by single rows of trees not in the experiment. There were four manure plots in duplicate and four control plots. The fertilisers used were as follows:—

Stable manure	plots 1 and 9,	average per year,	415·15 lb per tree
Superphosphate	,, 2 ,, 8	,, ,,	12·66 ,, ,,
Muriate of potash } Superphosphate }	,, 6 ,, 10	,, ,,	7·26 ,, ,, 12·6 ,, ,,
Muriate of potash } Superphosphate } Nitrate of soda } Dried blood }	,, 4 ,, 12	,, ,,	7·26 ,, ,, 12·6 ,, ,, 3·67 ,, ,, 12·84 ,, ,,

The trees used were Rome crown-grafted on Ben Davis, and were carefully selected in order to eliminate individual variation as far as possible. In estimating the value of the different fertilisers, the yield size, colour, flavour, time of maturity, texture of flesh, and keeping quality were considered, together with the diameter of the tree, the colour and weight of the foliage, and the length and weight of the annual growth of the branches. It was found that the colour, flavour, and keeping qualities were not influenced by the fertilisers, but that while the yield was not increased, the size of fruit was. Nitrogenous manures had the most noticeable effects; the foliage was greener and the annual growth of the branches was increased

POULTRY.

The Utility Poultry Club's Twelve Months' Laying Competition.—The report for the tenth period of four weeks states that, in spite of the prevalence of broodiness, the egg yield increased slightly, viz., to 7,884 eggs, as against 7,831 in the previous period This amounts to an average of 13 eggs per bird for the 28 days, by no means a poor average for the time of year The White Leghorns considerably improved their position during the period; the highest score for the month was made by a pen of White Leghorns, with a total of 125 eggs, valued at 11*s* 1¾*d*. The scores of the leading pens to the end of the tenth period were as follows:—

Order	No of Pen.	Breed	Total Eggs for 40 Weeks	Total Money Value. £ s. d.
1	60	White Wyandottes ..	1,062	5 4 7½
2	86	Buff Rocks	947	4 19 1
3	32	White Wyandottes	992	4 14 11¾
4	45	,, ,,	901	4 7 3¼
5	29	,, ,, ..	950	4 6 1½
6	35	,, ,, ...	896	4 4 11½
7	24	Black Leghorns ...	871	4 4 10½
8	54	White Wyandottes. ..	910	4 3 11½

NOTES ON AGRICULTURAL CO-OPERATION AND SMALL HOLDINGS.

Mutual Purchase and Sale between Agricultural and Industrial Co-operative Societies.

At the ninth International Co-operative Congress, which was held at Glasgow in August last, Herr Heinrich Kaufmann read an interesting paper on the direct exchange of goods between the various types of co-operative societies. He pointed out in particular the advantages of reciprocal purchase and sale between the large industrial distributive societies on the one hand, and the agricultural productive societies on the other. Herr Kaufmann gave the result of an inquiry which he had made into this subject, from which it appeared that, notwithstanding its obvious desirability, there is at present very little direct exchange of goods between the town and country organisations.

In the case of eleven societies in eight different European countries, the value of the supplies drawn from agricultural productive societies was £1,659,000, but the value of the goods sold to such societies was only £120,000. Moreover, even this latter amount is almost entirely made up of the sales of one society, viz., the English Co-operative Wholesale Society, which bought goods to the value of £111,300 from agricultural productive societies and sold goods to them to the value of £119,400. The purchases consisted mainly of butter and cheese (£100,000), the balance being made up of eggs, poultry, seeds, manure, corn, potatoes, fruit, and vegetables. The goods supplied to the agricultural societies were groceries and colonial produce (£118,000), with small amounts of cloth, woollen goods, boots, and furniture. The same society purchased largely also from foreign agricultural societies to the value of £3,206,000 (chiefly butter from Denmark), but the reciprocal sales were trifling.

Athough reciprocity does not appear to be so largely developed as is desirable, this is due probably in many cases to the fact that an agricultural productive society, such as a creamery, for example, is not normally a purchaser of the goods usually sold by an industrial co-operative society. It is, however, satisfactory to find that the sales of agricultural productive societies are to a certain extent made to the co-operative distributive societies, and it is in this direction that further development is needed At the present time the agricultural products of the rural districts are sold to the industrial districts chiefly through the agency of middlemen, but it should be possible, as the knowledge and practice of co-operation increase, for much of this produce to be sold through co-operative societies. Such co-operative sale societies would sell to the distributive societies in industrial districts, so that the whole operation of exchange between the agricultural producer and industrial consumer would be effected by co-operative organisations.

The discussion on Herr Kaufmann's paper was opened by Mr. E. J. Cheney, an Assistant Secretary of the Board of Agriculture and Fisheries, who spoke as follows :—

I deem it a great privilege to represent the Board of Agriculture and Fisheries on this occasion, and to have the opportunity of making a few remarks, however brief, in support of the important subject dealt with by Mr. Kaufmann in his admirable paper.

I need hardly say that the Board are concerned with the views expressed by Mr. Kaufmann, solely as far as they relate to matters that affect the farming community, and especially the small-holder.

There is probably no subject to which more attention is being directed in this country at the present time than to the problem of the land, a problem upon which widely divergent views are held, although everyone at work on it is striving to reach a common solution, under which it will be possible to establish on the land a contented, prosperous, and vigorous race of peasantry and small-holders.

Now there are three most important axioms in connection with the small holdings movement which are often lost sight of by people without practical experience of the return that is to be obtained from the cultivation of land:—

1. That it is a hopeless task to endeavour either to retain men on the land or to attract men to it, unless the wages that a small-holder can earn when working for himself, and the conditions under which he can live, are either better, or at least as good as those which he would be capable of obtaining if working in a town for someone else. And in this connection it must not be forgotten that something must be added to discount the amusements and attractions of the town.

2. That it is impossible for a small-holder to obtain the highest return from the land if he only cultivates the same crops as would be grown by a larger farmer.

3. That as the most profitable crops are also, as a rule, the most perishable ones, it is useless to produce them unless a ready market is available.

These self-evident truths are not properly appreciated by the general public, who are apt to think that the success or failure of a small holding is mainly a question of rent. Now rent, if it is fair and reasonable for the accommodation provided, is often quite a minor consideration; for if a small-holder grows the more intensive crops from which a net profit of from £5 to £15 and more per acre can be obtained—that is, if they are marketed to the best advantage—then 5*s.* to £1 an acre rent, one way or the other, does not make much difference to the success of the venture. If, however, a small-holder produces only the ordinary farm crops, rent becomes a very important consideration indeed, as he has then to be satisfied with the same profits per acre as the larger farmer, in which case it is conceivable that he would only be able to make a miserable living, even supposing that he held the land rent free.

I am satisfied, after a long experience of agricultural matters, that the main reason why the more modern and profitable methods of cropping are not adopted in this country, except in certain special districts, is because of the difficulty that is often experienced in finding a satisfactory market for the produce. It is infinitely easier to dispose of corn and stock, for example, than of vegetables, fruit, and flowers. Weeks, or even months, may result in no depreciation in the value of the former, whereas in the case of the latter, unless a satisfactory

market can be obtained on a particular day, profits disappear and the labour of months may be absolutely wasted.

The marketing problem is one of the most important, if not the most important, that confronts the small-holder who grows the more valuable but more perishable crops. There is strong reason for supposing, however, that the solution of the problem will be found in the adoption of some such methods as those advocated by Mr. Kaufmann, more especially those that relate to:—

"1. The sale of the produce of agricultural productive and sale societies to distributive societies in the same district; and, secondly, by the direct supply of goods to these agricultural societies by these same distributive societies.

"2. The sale of the produce of agricultural productive and sale societies to distributive societies in other districts of the same country, through the agency of distributive co-operative wholesale societies or central co-operative sale societies; and, secondly, by the supply of goods to these agricultural societies by the wholesale societies with which they maintain commercial relations."

I am fully aware, of course, that a certain amount of propagandist work has been done in this country with these objects in view; indeed, when a grant was first made to the Agricultural Organisation Society from the Small Holdings Account, care was taken to insure that one of the organisers appointed under the terms of the grant was engaged for the purpose of promoting interchange of trade between the agricultural and the industrial societies. In this and in other directions the Agricultural Organisation Society has done very valuable work, both in the way of keeping the co-operative movement before the agricultural community and in assisting in the formation of societies; but the time has arrived when the benefits offered must take a more tangible form, and effect a wider and more direct improvement in the condition of the small-holder than has been the case hitherto. Propagandist bodies cannot assist a society in its actual business or trading; this help must come from the larger trading societies on the lines indicated by Mr. Kaufmann, and it is here that the industrial societies of this country have such a splendid opportunity of helping forward a great national work. Before commenting further on this, I will refer to another matter mentioned by Mr. Kaufmann which has some bearing on the question.

It is extremely interesting to note that many of the difficulties experienced by societies in one country are identical with those that arise in another. Mr. Kaufmann agrees, for example, that among the principal causes of failure of certain societies are want of capital, an insufficient market for goods, inefficient management. These are difficulties that arise in connection with almost every small isolated Society in this country, as I fear that many of them are finding out to their cost. They are difficulties that can only be overcome by the federation of the smaller societies, or, better still, by their affiliation to existing large and powerful organisations; for there is no object in setting up new machinery if adequate machinery is in existence already.

I wish to offer a word of warning to farmers and their advisers on the question of capital. There is a good old Latin proverb, *Ne sutor supra crepidam* (let not the shoemaker go beyond his last); in

other words, it is primarily the business of the farmer to produce raw material, so to speak, in the shape of crops and stock, and not to produce the manufactured article, say bacon, jam, pickles, and the like. The farmer should be content to obtain the market value of the day for his produce and stock, for the raising of which he has, in many instances, all too little capital, and leave the commercial or distributive part of the business to the trading or manufacturing society, that is in a very much better position, both financially and otherwise, to deal with it. Agricultural societies should act, as a rule, merely as commission or collecting agencies, which can be run without encroaching seriously on the capital that is urgently required for the proper cultivation and stocking of the holding.

The pressing problem before us is how best to show small-holders the way to obtain a maximum return from the land. An ideal system would be for the large industrial society of a district to inform the small-holders of that district of the particular produce for which they have a market—and not only they, but also other industrial societies throughout the country—and to undertake to purchase it at market price. The local education authority, the County Council, should then step in and show the small-holder the way to produce the crops or produce required to the best advantage, and care should be taken to impress upon the small-holders the necessity for not having all their eggs in one basket, for owing to the vagaries of the English climate it is of vital importance to success that reliance should not be placed on one crop alone. Five or six kinds at least should be grown, all of which might not be successful in any one year, but which might be reasonably expected, taking one season with another, to return a good average profit.

To those of us who are acquainted with the striking improvement that has taken place in the condition of the small-holder in those comparatively few districts in which the more intensive crops are grown, it is clear what a sweeping revolution in the conditions of rural life is possible In those districts the men are independent, prosperous, and happy; a marked improvement has taken place in their standard of living, intelligence, and physique; and if proof is needed of the truth of what I say, it is only necessary to visit South Lincolnshire, the fen lands of Huntingdon and the Isle of Ely, the fruit-growing districts of Cambridgeshire and Worcestershire, the vegetable districts of Bedfordshire and North Gloucestershire, to obtain ample evidence of the improvement that has been effected in recent years in their rural economy. A satisfactory market, however, is absolutely essential to the success of the small-holder, and therefore I would urge the leaders of the industrial or distributive movement of this country to give their serious and urgent attention to forging a bond of union between the agricultural and industrial branches of the co-operative movement, whereby the organised working man of the country, the producer, is brought into direct touch with the organised working man of the town, the consumer. These men should be brought within the same fold, and each should strive to promote the welfare of the other.

I am authorised to say that Mr. Runciman agrees generally with the view that great good might result from a working arrangement between rural and urban co-operative societies—that is, between

organised producers and organised consumers, and I am confident that he would give very sympathetic consideration to any reasoned scheme that may be put before him and which it would be possible for him to assist.

The industrial co-operative movement of this country is built on the solid foundation of self-help, and it furnishes an example to the whole world of what can be effected by independence, perseverance, and grit, without anything in the nature of State assistance, charity, or philanthropy; and if the leaders of the industrial movement can evolve a comprehensive scheme on some such lines as those outlined by Mr. Kaufmann, and to which I am aware that some consideration has already been given, it is possible that you may furnish the solution of one of the most complex problems of modern times, and earn the lasting gratitude not only of those working men who live by the land, but of the whole country also.

The Lincoln Co-operative Society—an example of a successful Distributive Society.

The Lincoln Co-operative Society is an example of a combination of an agricultural productive society and a distributive society, some particulars of which are given in a paper by Mr. D. M'Innes, J.P., of Lincoln. This Society seems to have been established in 1878, and has been engaged in farming and fruit-growing since 1890, but does not deal in milk. Up to the end of 1910 the Society made moderate profits upon its farms, after paying interest and depreciation In 1911 there was a loss on one of the farms of over £1,000 arising from drought; but the Society is still buying land. It cultivates 587 acres. It lets as a landlord two small holdings. one of 4½ acres and a house, and the other of 9 acres and a house. It has created in one village, where there was a demand, eight acres of allotments, which are let to thirty-two holders, of a rood each

The Society, although it has its headquarters in Lincoln, has extended its work into adjacent country districts for a radius of 28 miles, and through this area it supplies its members with their requirements either by branches or by van deliveries. It is now doing a yearly trade of £86,000 among 3,541 members, who, beginning with nothing, have now £25,145 of share capital in the Society. Practically the whole of this has accumulated as dividend on the members' purchases. Goods are exchanged by the Society for butter, eggs, fruit, vegetables, &c., at current local market rates, to the value of £8,500 yearly. These rural members withdrew from the Society last year the sum of £8,569, and deposited in it, from their dividends and savings, £2,817; and this is a fair index of what goes on yearly. This privilege of using the Society as a bank from which they are at liberty to take withdrawable capital as they need it, is regarded by the agricultural class as being one of the greatest advantages of co-operation. The large amount annually taken out of the Society is used by rural workers to increase their power of production where they have allotments or small holdings, to give a better education to their families, and to raise their standard of living generally.

Mr. M'Innes adds that:—"The money obtained from trading with the society gradually converts day labourers who can get hold of land

into small producers on their own account, and enables small farmers and cottagers to buy stock with their own money instead of borrowing. Borrowing working capital, or taking up money on mortgage on ordinary lines, too often makes the position of small-holders one of lifelong drudgery and hopeless indebtedness. But co-operation, as practised by the Lincoln Society, has altered this for hundreds. It has created capital for them out of their custom at the store; and when the Society lends money on mortgage, repayments and interest are made monthly in money, or, in odd instances, in kind, and, as the accounts are balanced quarterly, the amount payable as interest is always being lessened. The total amount advanced on mortgage to country members to acquire houses or land is £8,377, at 4½ per cent., and of this amount £3,919 has been repaid by borrowers

"Stated briefly, the agricultural class in the country districts covered by the Society have obtained by co-operative trading the following:—Possession of £25,145 of capital; a market for a portion of their produce at their own doors; a bank which is continually receiving, in addition to deposits of small savings, dividends on members' purchases—a source whence money can be borrowed on mortgage at easy terms of repayment; and, lastly, constant contact and interchange of ideas with town workmen."

Leicestershire and Rutland Cattle Improvement Society.

This Society was formed in the year 1910 and registered under the Industrial and Provident Societies Act. Its objects are stated to be "to carry on the business of purchasing (or hiring) and maintaining pedigree live-stock, and the hire of same to members and others for stud purposes; the business of inspecting the live-stock of members and others; and any other business which may seem calculated to improve the live-stock in the county of Leicester or the adjoining counties." The chief object for which it was established was to provide good pedigree bulls from dams with milk-records of over 700 gallons per annum, and this purpose has been systematically and satisfactorily carried out. The Society is based upon shares which are transferable, but not withdrawable; they are of the nominal value of £1 payable in full on application; individual members must hold at least one share; no share is to carry interest or confer any right to dividends. Each member is to pay annually for the support of the Society 1*s.* for each cow kept by him (this rule has not been acted upon). The Society is affiliated to the Agricultural Organisation Society, which helped it with advice at the time of its registration, and last October sent one of its organisers to inquire into its working.

The Society purchased eight registered Shorthorn bulls (Coates' or Lincolns), selected as being of good milking strain, at a total cost of £256, an average of £32 per bull. Regarding the maintenance and use of the bulls the present arrangement is as follows. Each bull is placed out with an owner of cows, who agrees to provide and feed the bull and keep it in good condition; in return for this he receives no payment from the Society, but is allowed the use of the bull's services free of cost for his own cows up to a limit of 30; for any

of his own cows over 30 he has to pay 5*s*. a cow to the Society, and the same fee is charged to other persons who may make use of the bull; the bull-keeper is bound to allow only such cows, including his own, to be served by the bull as are accompanied by a nomination paper issued by the Secretary, which includes a declaration signed by the cow-owner that the cow has not aborted within twelve months past or been served by any other bull within a period of six weeks. The Committee are generally satisfied with the condition in which the bulls are kept by the bull-keepers.

From the balance sheet of the Society for the year ending December 31st, 1912, it appears that on that date the assets of the Society consisted of seven bulls then valued at £196 (an average of £28 per bull), and service fees owing to the Society £27, making their total assets £223. From this had to be deducted £22 due to sundry creditors, leaving a balance of assets over liabilities of £201; and as the share capital paid up was £255 in 255 shares of £1 each, the balance sheet showed a loss on the working of the Society to date of £54.

The actual cost of the bulls varied from £25 to £40; one bull, which cost the Society £36 15*s*., was sold in August, 1912, for £23 10*s*., on account of a growth which rendered him useless for stock-getting; and since the close of the year another bull, which also cost the Society £36 15*s*., has had to be sold for £17 10*s*. on account of not getting cows in calf. Taking things as they stood on December 31st last, the Society had bought eight bulls for £256, had received £23 10*s*. for one bull sold, and owned seven bulls estimated as worth £196, making £220 altogether, as against £256 originally paid. This meant a loss of £36 on eight bulls in two years, which would be equivalent to a loss of £2 5*s*. per bull per annum; but on the one bull they had actually sold the Society had lost £13 in two years, and they have since lost £19 on another bull sold, so that it would not be safe to estimate the depreciation per bull at less than £7 per annum, which might be reckoned in this way:—

The average cost of a good bull is, say	£35
Estimated price to be got for him after 2¼ years ..	20
Loss in 2¼ years	15
Equivalent to £7 per annum	

The actual cash income of the Society last year was £73 12*s*. 6*d*. from service fees, but the account shows that the amount earned during 1912 for service-fees was only £46 for 184 services at 5*s*. per service, an average of £5 15*s*. per bull. The total number of services given by the eight bulls in that year was 386, which gives an average of 48 per bull. The Committee consider 50 cows per bull per annum a fair average, as a cow often will not hold to one service, and as cows often come at irregular intervals into service. Of the 386 services 202 were given free to the farmers who keep the bulls, an average of 25 per bull. Last year the expenditure other than depreciation was as follows:—

	£	s	d.
Salary of Secretary ...	11	5	0
Insurance	13	3	0
Printing	6	5	0
Rent, etc.	10	7	0
	£41	0	0

or an average of £5 2*s*. 6*d*. per bull, leaving a balance of only 12*s*. 6*d*. per bull to meet depreciation, which is clearly not sufficient.

If the Society, while arranging for the keep of its bulls in return for 30 free services, could manage to work up to an average of 50 additional services at 5s. per service, it would have on eight bulls an average income of £12 10s., or altogether £100 a year, which would pay its working expenses, make a sufficient provision against depreciation, and give a small annual profit. If it can only raise the average number of services per bull to 60 per annum, the number of paying cows will be 240 for eight bulls, so that to attain the same result of being self-supporting the Society would have to charge 8*s*. 4*d*. for each service paid for. But unless it can either largely increase the number of services paid for, or increase the service fee, it is likely to continue to work at a loss and to see its share capital disappear.

It is reported that, while a calf by a common bull fetches only from 20*s*. to 25*s*., one by a Society bull fetches from 30*s*. to 45*s*., a gain of 10*s*. to 20*s*. per calf. It should therefore pay cow-owners to use the Society's bulls, even at 8*s*. 4*d*., in place of common bulls at 2*s*. 6*d*., as the extra expenditure of 5*s*. 10*d*. will bring in, in a year's time, an extra income of 10*s*. to 20*s*.

Castle Eden and District Entire Cart Horse Society.

This Society, which has been in existence for over fifty years, was established with the object of giving farmers in the Castle Eden district the opportunity of breeding from sound sires on reasonable terms.

A deputation of members, selected by the Society, visits stallion studs and selects two horses each year for the purposes of the Society. The horses must be passed as sound by a qualified veterinary surgeon, and proof must be given that they are safe stock-getters; the owner is required to enter into a written agreement with the secretary of the Society, promising to carry out its rules and conditions under a penalty of £60. He receives from the Society a premium of £60 for each horse, and, besides this, he is paid by the owners of the mares £1 for each mare served at the end of the season, and £2 when a mares proves to be in foal. The owner of the mare also pays the groom's fee of 2*s*. 6*d*. Non-subscribers using the horses pay 10*s*. extra for each mare.

The season commences on the first Monday after the Durham March Fair, and ends on the third Saturday in July. The horses are not to serve more than ninety mares each.

During each of the last five years the Society has secured the services of two horses, pure Clydesdales, their approximate market value varying between £200 and £350, and averaging about £300. The approximate number of mares served has been 176 per season, that is 88 per horse. It is estimated that the number of foals has averaged from 50 to 60 per cent. of the number of mares covered, which would give an average of 88 foals per annum.

At this rate the horse-owner received on the average in premiums £120, in service-fees £176, in foal money £176, total £472, or an average of £236 per horse.

The expenditure which had to be met by the Society averaged as

follows:—Premiums, £120; deputation expenses, £12; other expenses, £12; total, £144. Against this its income averaged as follows:—Subscriptions, £99; grants from the Durham County Agricultural Society, £20; entrance fees for studs, £3; interest, £2; total, £124; so there was an average loss on the Society's working of £20 a year, and the balance to the Society's credit decreased during the five years from £170 to £72. The Durham County Agricultural Society makes an annual grant of £25, but in one of the five years that sum was repaid by the horse society. The subscriptions are realised from gentlemen interested in the scheme, the usual amount being 5*s*., and the highest received being £3. The number of subscribers in 1912 was 259.

Thus under present arrangements the Society is working at a loss of £20 a year. The total expenditure it has to meet averages £144 a year, against which the only income, other than that from subscriptions and from the grant made by the Durham County Agricultural Society, is about £5, so that in order to place the Society on a self-supporting basis it would appear to be necessary to charge owners of mares a subscription of 16*s*. per mare, in addition to what they pay to the owners of the stallion, so that an owner would pay altogether £1 16*s*. for a service which left the mare barren, and £3 16*s*. for a service which resulted in a foal.

Government Loans to Agricultural Associations in British Columbia.

The Agricultural Associations Act of March 1st, 1911, of the province of British Columbia, as amended by the Agricultural Associations Amendment Act of March 1st, 1913, provides for the granting of loans by the Government of British Columbia to agricultural associations in the province, incorporated under the former Act, and having as their objects the "erecting, or acquiring and maintaining, managing and operating" of various agricultural industries.

The sum lent to any one association is not to exceed 80 per cent. of its subscribed capital. It must be shown, *inter alia*, that the district in which the association proposes to operate is competent and fitted for its support, and that there is a reasonable prospect of the same being a financial success; and that the association has acquired the necessary plant and buildings for the carrying-on of its operations, or a site upon which to erect such necessary plant and buildings; and the acquisition of the plant and buildings, or the plans of the buildings and the nature and cost of the proposed plant and equipment must have been approved by the Minister of Agriculture.

Loans so made are to be repaid within twenty years, and interest is to be paid by the association on the whole amount of the loan, at the rate of 4 per cent. per annum, until fully repaid. The capital sum is to be repaid by yearly instalments so fixed that these, together with the compound interest accruing on them (when invested in public securities), will amount at the end of the twenty years to the sum borrowed. The Minister of Agriculture has a first charge and mortgage upon all the property and assets of the association until the loan and interest are fully repaid, and the accounts must at all times be open to his inspection.

OFFICIAL NOTICES AND CIRCULARS.

National Health Insurance. Explanatory Memorandum for the Information of Farmers.

It has come to the notice of the Commissioners that the provisions of the National Insurance Act on some points of particular interest to farmers as employers of labour are not generally known. The most important of these topics are dealt with below.

Points of difficulty should be referred to the Local Officer of Customs and Excise, whose address may be obtained at the Post Office, or, where this is inconvenient, they should be submitted in writing to the Secretary, National Health Insurance Commission (England), Buckingham Gate, London, S.W. Information on matters not dealt with in this memorandum may be obtained from the official leaflets, which will be supplied free on application being made to the Local Officer of Customs and Excise, or to the Commissioners. The Commissioners will always be glad to advise, so far as lies in their power, in matters of difficulty arising under the Act.

Payment of Contributions.—The responsibility for procuring stamps and affixing them to a worker's contribution card rests solely on the employer.

Until the employer has paid the contribution by stamping the card and cancelling the stamp by writing the date on it, he is not entitled to deduct the worker's share of the contribution from wages. He is only entitled to make the deduction from the wages for the period for which the contribution is due. Thus, if he pays wages weekly, the card should be stamped each week, and he has no right to deduct more than one week's contribution from any week's money.

Rates of Contributions.—The ordinary rule for the rate of contribution is that the employer pays 7*d.* in the case of a man, and, subject to the above paragraph, has the right to deduct 4*d.* from the employed person's wages.

In the case of women, the employer pays 6*d.*, and has the right to deduct 3*d.* from the employed person's wages.

This applies without exception to all persons under 21.

In other cases the rates of contribution are subject to the following variations:—

When the employed person is 21 or over and does not receive both board and lodging from the employer.

(*a*) In the case of men when the rate of remuneration is more than 2*s.*, but not more than 2*s.* 6*d.* a working day:—

	A week.
To be paid by the employer	4*d.*
To be paid by the man	3*d.*

(*b*) When the rate of remuneration is more than 1*s.* 6*d.*, but is not more than 2*s.* a working day:—

	A week. Men	Women.
To be paid by the employer	5*d.*	4*d.*
To be paid by the employed person	1*d.*	1*d.*
To be paid by the State	1*d.*	

(*c*) When the rate of remuneration is not more than 1*s.* 6*d.* a working day:—

	A week. Men.	Women.
To be paid by the employer	6*d.*	5*d.*
To be paid by the State	1*d.*	

In this case the employed person does not pay any part of the contribution.

In cases under (*b*) and (*c*) the employed person should obtain from his Approved Society or from the Post Office a special low-wage contribution card, and produce it for stamping instead of the ordinary contribution card. If he fails to produce such a card, his employer is required to obtain one from the Post Office. It is important that the instructions on the card should be carefully followed by the employer.

Rate of Remuneration.—In calculating the *rate of remuneration*, the value of any privileges, allowances, or perquisites and of any payments in kind should be taken into account, *e.g.*, milk, cider, free cottage, fuel, potato ground, &c. The value to be put upon such allowances is the *value to the employed person*, *i.e.*, the amount which he is able to save through not having to provide the things in question for himself. If the farmer and his employee cannot agree on this, the question should be referred to an Officer of Customs and Excise. Each week must usually be considered by itself with reference to the remuneration received for work done in that week. Where extra payments are made for special services (*e.g.*, threshing money, harvest money, &c.) *the extra sum should only be taken into account for the period during which the services are rendered.* Thus, in calculating the rate of remuneration, harvest money should be spread over the weeks of harvest and taken into account for those weeks only, and not for the whole year.

If wages are paid on a weekly basis, the rate of remuneration per working day will be found by dividing the total paid for the week (including allowances, extras, payments in kind, &c.) by the number of days in the week on which work is ordinarily done. Every day on which any work at all is done should be counted. Thus a horseman who receives 15*s* a week cash, and extras (*e.g.*, a free cottage and potato ground), equivalent to a shilling a week, making a total remuneration of 16*s.* a week, and has ordinarily to perform some Sunday work, will have as his rate of remuneration per working day $\frac{16s.}{7} = 2s.\ 3\frac{1}{2}d.$ (about) Thus if he is over 21 his employer will pay 7*d.* and have the right to deduct 3*d.* from wages.

High Value Stamps.—An employer who is prepared to pay all the contributions for any insurance quarter at the beginning of the quarter, or who pays wages at quarterly or longer intervals and whose date for payment of wages is near the end of an insurance quarter, may obtain from the Post Office stamps representing *a whole quarter's contributions.* In these cases the trouble of weekly stamping will be avoided.

Reduced Contributions in Certain Cases.—In the following cases when the rate of remuneration is at least ten shillings a week, farmers are allowed the option of paying contributions at the ordinary rate,

or of paying reduced contributions and accepting liability for the payment of wages during certain periods of sickness provided they give notice to the Commissioners that they desire to adopt the reduced rate of contributions :—

Employment as any kind of farm servant under a contract of not less than six months' duration (male persons only) in Northumberland and Durham, Yorkshire (N. and N.E. parts of the North Riding).

Employment as a farm servant in charge of animals (male persons only) in Berks, Cambridgeshire (North), Dorset (E. and S.), Gloucestershire, Hampshire, Kent, Lincolnshire, Nottinghamshire, Oxfordshire, Rutland, Warwickshire, Wilts, Worcestershire, Yorkshire (E. Riding).

Employment as a farm servant (male unmarried persons only) in Cumberland, Westmorland, parts of Lancashire, namely, the hundreds of North and South Lonsdale, Amounderness, Leyland and Blackburn, Yorkshire (W. Riding).

Employment as a farm servant (male unmarried persons only) under a contract of not less than six months' duration, where the terms of service include board and lodging in the farmhouse, in Cheshire, Derbyshire, Hereford (West), Shropshire, Staffordshire.

Employment as a domestic servant in any county.

The farmer who adopts the alternative scheme by giving formal notice to the Commissioners (from whom full particulars can be obtained) will have his share of the contribution reduced by 1*d.* in the case of a man and ½*d.* in the case of a woman and his employee's share reduced by 1*d.* in the case of both men and women. Thus 5*d.* stamps will be affixed instead of 7*d* stamps in the case of men, and 4½*d.* stamps instead of 6*d.* stamps in the case of women. But the farmer will make himself responsible for the payment of full remuneration during sickness as follows :—

(*a*) If the engagement is for six months certain or more, he will be responsible *for any period of sickness lasting not more than six weeks,* however many such periods there may be in the period of the engagement.

(*b*) If the engagement is for less than six months certain, and can be terminated by not less than a week's notice, he will be responsible *for sickness for a period not exceeding six weeks in any one year.*

Farmers' Sons and Daughters.—Sons and daughters, 16 years of age or over, who work on or about the farm must be insured unless they receive no wages or other money payment whatever in return for their work.

By "money payment" in this connection is meant something not unlike wages in its general effect, *i.e.*, payment made in respect of services rendered. An occasional gift of pocket money would not, as such, be a payment for services rendered; but if the payment, though called "pocket money," were in any way conditional upon the performance of the duties (as would probably be the case if it were made regularly), it would be regarded as money payment in respect of the employment. The best test to apply is whether the pocket money would be continued in full if for any reason the son or daughter ceased to render services. If the pocket money is withheld when the services cease to be rendered the payment would be in respect of the employment. In this case, the son or daughter would have to be insured.

It is important to observe that failure to insure a son employed on a farm before July 15th, 1913, will permanently prejudice his position if, after that date, he obtains employment elsewhere and has to be insured.

For example, a son who fails to become insured before July 15th of this year but later on becomes insured at the age, say, of 22 years, will only be entitled to 7*s.* 6*d.* a week sickness benefit, though he pays the ordinary rate of contribution for the rest of his life.

If he wishes to render himself eligible for the full sickness rate of 10*s.* a week, he will have to pay a lump sum of £2 9*s.* 6*d.* to his Approved Society.

Casual Labour.—In some districts mistakes have arisen as to persons casually employed in farm work. *The General Rule is that a Man or a Woman employed on or about a Farm, whether regularly or casually, must be Insured.* The length of engagement, whether it is for a year or a month or a day or less, is of no importance in this connection. If a farmer takes on a person of either sex, aged 16 or more, whether the engagement is for a specified time or otherwise, and whether payment is to be made by time, by piece, or by the job or contract, he becomes responsible for stamping his or her card, if it has not been already stamped for the particular week, or, if an ordinary contribution card is not produced, for stamping an emergency card which can be obtained on application at any Post Office.

Women employed to help in the house regularly one or more days a week must be insured, and the first employer in the week is responsible for the payment of the contribution.

Threshing.—Men employed casually to help in threshing must be insured, and their cards must be stamped in respect of their first period of employment in each week. The answer to the question whether the farmer or the threshing machine owner is responsible will depend on the terms of the arrangement made between the farmer and the owner.

In some districts the threshing machine owner takes on his own casual men, or, although the farmers for convenience engage them and hand them their wages, the machine owner controls their work. In these cases the machine owner will be responsible for stamping and the individual farmer has no direct responsibility for health insurance.

In other districts it is customary for the farmers to engage, control and pay directly the casual men required. In these cases the full responsibility and cost of the whole week's insurance is thrown on the first farmer in the week who happens to engage the casual men, and farmers who employ them later in the week incur no liabilities for insurance.

Piece and Contract Workers.—Some farmers have the impression that piece workers and contract workers need not be insured. This is quite incorrect. *Generally speaking, Piece Workers and Contract Workers must be Insured.* Liability to insurance does not depend on the method by which a man is paid for his work, but on whether or not he works under a contract of service. If the person for whom he works can, if he pleases, give orders and directions as to the method by which jobs shall be carried out, then the worker is liable to be insured. It does not matter that in practice a farmer does not interfere

with the details of the work of an experienced labourer working on piece. If he has the right to interfere when circumstances seem to him to require it, then a contract of service exists, and the worker must be insured. Thus men employed to hoe turnips, to dig potatoes, to cut hedges, &c., and paid by the piece or by contract, are usually under a contract of service and should be insured.

Questions also arise as regards the insurance of men employed under gangers. If the ganger is in fact an independent contractor with whose work the farmer cannot interfere once the price has been settled and the job started, then the ganger will be responsible for the men engaged by him. But where, as is often the case, the ganger is in fact a labourer whose position is substantially the same as that of the men whom for convenience he engages, and the farmer can, if he pleases, exercise general supervision over the progress of the work, then the duty of insuring all the persons employed will rest on the farmer.

Women Field Workers.—Generally speaking, all women employed on farms must be insured in the same way as men.

The liability to insurance of a married woman employed on a farm is not affected by the fact that her husband is also insured Unless she produces an exemption book the usual contributions must be paid. If she produces an exemption book the employer should obtain an exemption card from the Post Office and stamp it with the amount of his own share of the contribution only. This amount depends on the rate of remuneration as explained above

Irish Migratory Labourers—In the case of an Irish migratory labourer who produces an exemption book, the farmer should obtain from the Post Office and stamp an exemption card with the amount of the employer's share of the ordinary contribution

Unless an Irish labourer produces an exemption book, he must be insured on the ordinary basis.

Subsidiary Employments.—The following classes of agricultural employments are excluded from compulsory insurance under the Act in those cases where the person engaged in the employment was not immediately before the employment an insured person or is not the holder of a special exemption book granted in certain circumstances to Irish migratory labourers, viz —

Hop picker.
Fruit picker
Pea picker.
Potato picker.
Flower puller
Onion peeler.

In these cases, therefore, if the farmer is satisfied that the employed person was not previously insured (for example, in the case of a woman who is usually occupied in her own home in household duties but does some fruit picking in the summer), no contributions need be paid either by farmer or worker. But unless the worker can satisfy the farmer that he was not previously an insured person, a card must be stamped in the ordinary way.

Further, persons employed as milkers or to deliver milk in the early

morning before 9 a.m., who are not ordinarily employed in any other capacity by the farmer, and persons employed as hop tyers need not be insured by him in respect of such employment.

The Board have addressed the following circular letter, dated 23rd August, 1913, to Local Education Authorities as to the provision of agricultural education by means of organised day courses.—

Provision of Agricultural Education by means of Organised Day Courses.

SIR,

I am directed by the Board of Agriculture and Fisheries to say that pending the establishment of Farm Schools or Farm Institutes, they desire to draw the attention of Local Education Authorities to the desirability of establishing day courses of instruction in agricultural subjects similar in type to those which would be held at a Farm School. Such courses are at present held in several counties, and are sometimes described as "Young Farmers' Classes" or as "Winter Schools of Agriculture."

Their essential characteristic is that they provide a short course of instruction in related subjects at a fixed centre, the class meeting daily for a month, or from two to four days a week during the period from November to March. The subjects of instruction may, however, be varied according to local requirements so as to include any branch of Agriculture, Horticulture, Dairying, Veterinary Hygiene, Poultry or Bee-keeping, but the instruction should aim at explaining the principles of the subject in a manner suited to the intelligence of the class, and should be accompanied by practical demonstration work. In the case of Dairying, the travelling Dairy Van, which has been so successfully employed in many counties, is an example of one kind of Organised Day Course. Practical instruction in Poultry-keeping might, in a somewhat similar way, be undertaken at Rural Centres, while Horticulture and Bee-keeping also lend themselves to short courses of instruction of a fortnight and upwards at suitable periods of the year

In Counties where an Agricultural Instructor is already at work, the instruction required for Winter Classes in Agriculture might be arranged by selecting two Centres, at each of which instruction would be given on two days in the week from the beginning of November until the middle or end of February In certain counties it may be found desirable to appoint one or more additional Agricultural Instructors for this work, and in such cases classes might be held at three centres for two days each week. A qualified Veterinary Surgeon might be employed to give, say, twelve lectures during the session on veterinary hygiene, and an Instructor in Horticulture might give lessons and demonstrations once or twice a week on horticulture. Classes for technical instruction in Poultry-keeping might also be held at separate centres for two hours or more daily, during a period of three weeks. The object of such classes should be to give practical instruction in all branches of Poultry-keeping

The equipment necessary for such instruction need not be elaborate or costly, and as the numbers to be admitted to any one class should not exceed twenty, a moderate-sized room would serve for accommodation.

The Board think that there is a considerable opening for well organised instruction of this type, for it is by such short courses that systematic teaching in agriculture can be brought within the reach of all classes of young agriculturists. In those counties where a definite Farm School has not yet been established, it would seem that an experiment in the establishment of these organised day courses might well be made during the coming winter, and where a farm school exists days courses would prove useful in outlying districts. In such cases they should serve as feeders to the Farm School, and an endeavour should be made, by the award of scholarships or by offering free tuition, to encourage promising pupils to continue their studies at the Farm School. In the same way the brighter pupils attending Evening Classes should be encouraged to continue their studies at Organised Day Courses.

The minimum age of admission should be sixteen, and it would be desirable that if any fees are charged they should be small In some cases it may be necessary to provide travelling allowances for pupils coming from a distance

The Board would be glad if your Committee would give this proposal their favourable consideration, and in the event of any such courses being established, they will be prepared to make grants in respect of them under the Farm Institute Scheme.

I am, &c.,
SYDNEY OLIVIER,
Secretary.

Imports and Exports of Agricultural Produce in 1912.

Part IV. of the Agricultural Statistics for 1912 [Cd. 7013, price 5*d*.], recently published by the Board, deals with the imports into and exports from this country of corn, live stock, and other agricultural produce in 1912 and previous years, the changes in the trade in agricultural produce being shown in some cases to as far back as 1861. The growth in the agricultural imports is discussed in some detail by Mr. R. H. Rew.

The Board of Agriculture and Fisheries desire to give notice of the publication of the Summary of Progress of the Geological Survey of Great Britain for 1912.

Progress of the Geological Survey.

This volume gives an account of the work of the Geological Survey for the past year.

In England and Wales work has been continued in the Denbighshire district, in the Warwickshire and South Staffordshire district, and in the London and S.E. district. In the Denbighshire district progress has been made with the surveying of the coal measures and the older and newer rocks, while in the Warwickshire and South Staffordshire district the northern portions of the visible coalfield have been completed, as well as the intervening area occupied by the New Red Sandstone formation.

The original survey of Scotland has been continued in the West Highland district (the area surveyed lies entirely in the Island of Mull),

and in the North and Central Highland district comprising parts of the counties of Sutherland, Ross, Perth, Inverness, and Argyll. Revision of the Carboniferous areas was carried on in the Kilmarnock and South Lanarkshire districts.

In addition to a summary of the results obtained during this work, there are appendices dealing with (1) Palæolithic Gravels near Swanscombe, Kent, (2) analysis of water at "The Mount," Fareham; (3) a boring at the East Anglian Ice Co.'s Works, Lowestoft; (4) a boring near Henlow Station, Bedfordshire; (5) a boring at Batsford, near Moreton-in-Marsh; and (6) the Copper Lodes of Inveryne and Kilfinan, Argyllshire.

Copies may be obtained from any agents for the sale of Ordnance Survey Maps, or through any bookseller, from Mr T. Fisher Unwin, 1 Adelphi Terrace, London, W.C., who is the wholesale agent for the sale of Geological Survey Memoirs in the United Kingdom (except in the County of London), price 1*s*.

Periodical and Serial Publications in the Library.

A Catalogue of Periodical and Serial Publications filed in the Library of the Board of Agriculture has been published as No. 14 of the Board's Miscellaneous Publications series (price 3*d*. post free, to be obtained at the office of the Board, 4 Whitehall Place, London, S W). Under the heading of periodical and serial publications are comprised all publications forming part of a series or issued at more or less regular intervals, so that the present catalogue furnishes a list of the Annual Reports, Year-Books, Bulletins, Reviews, Journals, &c., filed in the Library of the Board. Any of the publications may be consulted at the Board's Library, 8 Whitehall Place, S.W., between the hours of 10 a.m. and 5 p.m. (Saturdays, 10 a.m. and 2 p.m.).

Proceedings under the Diseases of Animals &c., Acts for 1912.

The Annual Report for the year 1912 by the Assistant Secretary (Animals Division) of proceedings under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, &c., has been recently published. A large part of the Report is taken up by a history of the outbreaks of foot-and-mouth disease last year and an account of the efforts made by the Board to combat the disease. The position of the country as regards swine fever and sheep scab are discussed, and maps are given showing the outbreaks of these two diseases in 1910, 1911, and 1912 A useful feature of the Report is a list of Orders of the Board in operation on January 1st, 1913.

MISCELLANEOUS NOTES.

National Diploma in Horticulture.

It has long been felt desirable in horticultural circles that some diploma should be available for professional gardeners, the holding of which should be an indication of real professional ability. In 1912 the Council of the Royal Horticultural Society accordingly approached the Board of Agriculture on the subject, with the result that the approval of the Board was given to the proposal, and authority was given for the diploma to carry the title "National."

The examinations for the National Diploma in Horticulture are open to men and women, and will, as far as possible, be held in the latter part of June of each year Candidates will be required to register themselves with the Royal Horticultural Society and to pass two examinations, a preliminary and a final The first examinations will be held in June, 1914, and those desiring to enter should at once make application to the Secretary of the Royal Horticultural Society, Vincent Square, Westminster, S.W , for the syllabus

Among those for whose benefit the Diploma is established are the following .—Florists, fruit-growers, gardeners, horticultural inspectors, horticultural instructors, landscape gardeners, market gardeners, nurserymen, public park gardeners, and seedsmen.

Horticulture is defined as being a definite craft of itself and not a department of agriculture, and as including the more intensive cultivation (as usually practised in gardens) of fruit, vegetables, flowers, shrubs, and ornamental trees

Laying Competitions of the Utility Poultry Club.

The twelve months' laying competition of the Utility Poultry Club, which is at present in progress at the Harper Adams Agricultural College, and towards the cost of which a grant of £500 was made by the Development Commissioners, will be concluded on October 14th next. A second twelve months' competition, under the direction of the Utility Poultry Club, will, however, commence at the College on October 25th A grant of £225 from the Development Fund has been made in respect of the further competition. Accommodation for fifty pens of six birds each will be provided The prizes consist of gold, silver, and bronze medals, and the entry fee is £1 10s. The last day for receiving entries is September 23rd.

Arrangements have also been made for carrying out a third competition. This will be divided into two sections, and provision will be made for 32 pens of four birds each in both sections. Section 1 will be conducted on the ordinary small house and run system; Section 2 on the semi-intensive system. In order to obtain as accurate a test as possible of the two systems, competitors must enter in both sections a pen of the same breed, and, if possible, of the same strain. The last day of entry was September 15th, and the competition commences on October 15th. It will be held on the farm of Mr. J. N. Leigh at Sedlescombe, near Battle, Sussex, where an entirely new plant is being

erected for the purpose. A grant of £207 has been recommended by the Development Commissioners in respect of this third competition.

Further particulars may be obtained by sending a stamped addressed envelope to the Publishing Office of the Utility Poultry Club, 68B Lincoln's Inn Fields, London, W.C.

Importation of Potatoes into Argentina.—The Board of Agriculture and Fisheries desire to give notice that they have received through the Foreign Office a copy of a Decree governing the importation of potatoes into Argentina.

Importation Regulations.

The Decree, which came into force on July 29th, 1913, provides that all potatoes imported into the Republic shall be accompanied by (*a*) "Sanitary-origin" and (*b*) "Sanitary" certificates, duly legalised by an Argentine Consular Officer.

Certificates issued by duly qualified persons who are authorised by the Government of the country of origin will be recognised as "certificates of sanitary origin" provided that they certify to the satisfactory sanitary condition of the land as regards the following diseases and pests:—

Synchitrium endobioticum (Wart Disease)
Phytophthora infestans (Ordinary Potato Disease or "Blight")
Rhizoctonia solani.
Heterodera radicicola (Eelworm).
Lita solanella (Potato Moth).
Scabs and "Dry Rot" attributable to bacteria and fungi.

The certificate must also show the date of the crop, the quantity or weight of the potatoes, the name of the grower, and of the person to whom they will be shipped. In the event of any of the above diseases being discovered, the affected consignment will be reshipped or destroyed

Certificates will be recognised as "sanitary certificates" which are issued by the foreign authorities referred to above, or by a technical officer of the Directorate General of Agriculture, provided that they state (1) that the potatoes appear to be free from the diseases and pests specified above; (2) the quantity or weight of the potatoes and the marks of the boxes in which they are packed; (3) the name of the steamer by which they will be shipped, the name of the person to whom they are consigned, or representative in the country of destination; and (4) the date of issue of the certificate The necessary inspection for this certificate must not be made for at least a month after the date of issue of the certificate of sanitary origin.

These certificates will suffice for potatoes landed at Buenos Aires, but if consignments are entered through any other port, further certificates are required, particulars of which will be supplied by the Board on application

Persons desirous of exporting potatoes to Argentina should communicate with the Board in order that arrangements may be made for the necessary inspection of their crops.

Importation of Seeds, Plants, Manures, &c., into Uruguay.—The importation into Uruguay of seeds, plants, manures, and other products

which may propagate agricultural pests, is allowed only through the ports of Montevideo, Mercedes, Salto, and Colonia. (*Board of Trade Journal*, August 7th and 21st, 1913.)

Importation of Pines and Cotton Seed into the United States.—Notices of Quarantine Nos. 7 and 8 of the United States Department of Agriculture prohibit respectively the importation of all five-leafed pines and of all species and varieties of cotton seed and cotton-seed hulls.

Importation of French Thoroughbred Horses for Breeding into the United States.—Thoroughbred horses registered in the French Thoroughbred Studbook (Studbook Français, Registre des Chevaux de Pur Sang) (provided that they trace in all crosses to animals registered in the General Studbook of England or to animals which are proved to the satisfaction of the United States Department of Agriculture to be of the thoroughbred breed, and to have been imported from the country in which the breed originated) have been recognised by the United States Department of Agriculture as pure-bred for the purposes of duty-free importation into the United States under the Act of Congress of August 5th, 1909, relating to the importation of pedigree stock for breeding purposes. The regulations with regard to the certification of pure-bred animals, together with the list of breeds of animals originally recognised, were given in this *Journal* for March, 1911, p. 1029.

Importation of Animal Products, &c., into Sweden.—With reference to the restrictions placed on the importation of certain animal products into Sweden from Great Britain owing to the existence of foot-and-mouth disease in this country,† the Board of Trade have now received, through the Foreign Office, a copy of a notice issued by the Swedish Board of Trade, which declares Great Britain to be free from that disease. (*Board of Trade Journal*, July 31st, 1913.)

Notes on Agriculture Abroad.

Agricultural Education in Canada.—The Bill for aiding agricultural instruction in the Canadian provinces, which was introduced into the Canadian House of Commons,* became law on June 6th, 1913. It provides for the expenditure on agricultural education during the ten years 1913–14 to 1922–23 of 10,000,000 dollars (nearly £2,100,000). This sum will be apportioned at the rate of £146,000 in 1913–14, the annual amount rising by £21,000 each year until it reaches £230,000 in 1917–18, and continuing at this figure for each of the remaining five years. The money for each year will be allocated as follows.—(*a*) An amount not exceeding 20,000 dollars (£4,170) will be paid to veterinary colleges established in the provinces, to be distributed in proportion to the number of students enrolled in the previous year. (*b*) A like sum will be paid to the Government of each province. (*c*) The remainder of the appropriation for the year will be paid to the Governments of the respective provinces in proportion to their populations. These payments will be conditional upon agreement between the Minister of Agriculture and the Government of each province as to the purposes for which the money is to be employed.

† See *Journal* for Nov. 1912, p. 696, and Nov 1911, p 690.
* See *Journal* for April, 1913, p. 74.

Establishment of Agricultural Schools in New Brunswick.—The Board have received a copy of an Act which provides for the establishment of agricultural schools at such places in the province of New Brunswick as may be decided upon by the Lieutenant-Governor-in-Council, who is empowered to purchase such land and erect such buildings as he may deem necessary for the purpose. The curriculum at the schools will include agriculture, horticulture, forestry, the care and management of farm animals, butter and cheese making, manual training, and kindred subjects, as well as the elements of sciences bearing on these subjects The schools will be under the management of the Department of Agriculture of New Brunswick, which will have authority to regulate the conditions of admission; to fix the fees for tuition; to arrange the courses of study; to regulate the conduct and work of students, certificates of proficiency or other awards to be given, after examination, on each of the subjects; and to pass, subject to the approval of the Lieutenant-Governor-in-Council, such by-laws, rules, and regulations as may be deemed necessary The appointment of professors, lecturers, and other officers will be in the hands of the Lieutenant-Governor-in-Council The Department of Agriculture will have power to expend money for the purposes of the schools up to the amounts authorised by the Lieutenant-Governor-in-Council A full report of each school must be submitted annually to the Legislative Assembly by the Department of Agriculture

Statistics of the Dairy Industry in the United States.—There were, in 1909, in the United States 8,479 establishments for the manufacture of butter, cheese, and condensed milk, with an output valued at £57,200,000 Of these establishments, 56·4 per cent reported butter as their product of chief value, 42 per cent cheese, and 1·6 per cent condensed milk The output of the butter factories was £40,625,000, of the cheese factories £9,222,000, and of the condensed milk factories £7,353,000. The cost of the materials used in the industry constituted a very large proportion, viz, 85·8 per cent of the total value of the products. The factories gave employment to an average of 31,506 persons in 1909, and a total of £3,057,000 was paid in wages

In 1909 the combined production of butter in the factories of the butter, cheese, and condensed milk industry and on farms amounted to 1,619,415,000 lb, an increase of 8·6 per cent. over the production in 1899. During the decade the output of the factories increased by 48·7 per cent, and the production on farms decreased by 7·2 per cent The production on farms formed 71·8 per cent of the total in 1899 and 61·4 per cent. in 1909.

The quantity of cheese produced in the factories of the industry and on farms amounted in 1909 to 320,532,000 lb, an increase of 7·4 per cent. over the production in 1899. The output of the factories increased by 10·3 per cent., and the production on farms decreased by 42·6 per cent. The proportion made on farms decreased from 5·5 per cent. in 1899 to 2·9 per cent. of the whole in 1909. (*Report of the Bureau of the Census of the U S. Dept of Commerce.*)

Budget of the Swedish Ministry of Agriculture for 1914.—The Swedish Budget for 1914 sanctions an expenditure on agriculture of £592,000, as compared with £570,000 in 1913 Provision is made for an ordinary expenditure of £309,000 and an extraordinary expenditure of £283,000.

The increase of £22,000 includes a sum of nearly £6,000 for veterinary education and £5,000 for upkeep of roads in country districts. The extraordinary expenditure includes a sum of £15,000 for assistance to small holders. Of the total sum of £644,000 to be raised for State loan funds, £377,000 is to be devoted to small holdings.

The Weather in England during August.

District	Temperature.		Rainfall			Bright Sunshine	
	Daily Mean	Diff from Average.	Amount	Diff from Average.	Number of Days with Rain	Daily Mean	Diff from Average
Week ending Aug 2nd	°	°	Inches	Inches		Hours	Hours
England, N E	57·8	−0·9	0·00	−0·69	0	5·8	+0·2
England, E	58·6	−1·9	0·00	−0·49	0	5·7	−0·5
Midland Counties	60·5	+0·7	0·00	−0·56	0	5·7	+0·1
England, S E	60·6	−0·9	0·00	−0·48	0	6·8	+0·4
England, N W	60·2	+1·2	0·00	−0·78	0	8·5	+3·0
England, S W	61·4	+1·5	0·03	−0·64	1	8·9	+2·7
English Channel	62·4	+0·7	0·78	+0·25	2	6·2	−1·8
Week ending Aug 9th							
England, N E	55·4	−3·0	0·20	−0·40	2	6·5	+1·1
England, E	55·5	−4·7	0·16	−0·33	1	6·7	+0·6
Midland Counties ...	56·2	−3·2	0·21	−0·33	1	4·8	−0·8
England, S E	56·7	−4·6	0·19	−0·27	1	4·9	−1·6
England, N W	55·9	−2·7	0·42	−0·35	2	7·6	+2·4
England, S W	57·6	−2·0	0·27	−0·38	1	6·5	+0·3
English Channel	59·6	−2·2	0·20	0·36	2	6·7	−1·4
Week ending Aug 16th							
England, N E	57·8	−0·2	0·11	−0·47	2	3·5	−1·8
England, E	59·0	−1·0	0·36	−0·19	3	4·6	−1·5
Midland Counties	60·0	+0·9	0·25	−0·34	3	2·1	−3·5
England, S E	61·0	−0·1	0·11	−0·44	3	3·8	−2·7
England, N W	59·2	+0·9	0·38	−0·42	4	3·1	−2·1
England, S W	61·4	+2·1	0·34	−0·39	3	3·5	−2·7
English Channel	62·0	+0·3	0·56	−0·04	4	5·3	−2·6
Week ending Aug 23rd							
England, N E.	57·8	+0·3	0·56	−0·06	3	4·1	−0·9
England, E	59·8	+0·4	0·21	−0·35	3	4·5	−1·4
Midland Counties	58·9	+0·5	0·50	−0·15	2	4·4	−0·9
England, S E . .	60·7	+0·1	0·11	−0·52	2	5·8	−0·4
England, N W	57·4	−0·5	1·18	+0·29	3	6·5	+1·6
England, S W	60·2	+1·3	0·37	−0·49	3	6·9	+1·0
English Channel	61·6	+0·2	0·26	−0·39	2	8·5	+1·3
Week ending Aug 30th							
England, N E	60·2	+3·5	0·30	−0·34	2	7·0	+2·2
England, E	61·9	+3·4	0·18	−0·36	2	7·4	+1·9
Midland Counties	60·9	+3·5	0·37	−0·27	2	6·0	+1·2
England, S E	62·2	+2·6	0·39	−0·27	3	6·5	+0·8
England, N W	60·5	+3·5	0·12	−0·77	2	7·5	+3·0
England, S W	61·7	+3·6	0·21	−0·68	2	5·[illegible]	−0·4
English Channel	62·5	+1·8	0·35	−0·31	3	5·5	−1·0

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for August, issued by the International Agricultural Institute, gives estimates of the production of cereals in the following countries. The total production of wheat in Prussia, Belgium, Bulgaria, Denmark, Spain, England and Wales, Hungary (excluding Croatia and Slavonia), Italy, Luxemburg, Russia (63 European and 10 Asiatic Governments), Switzerland, Canada (winter wheat only), United States, India, Japan, Algeria (excluding the Department of Algiers), and Tunis, is estimated at 335,448,000 qr., an increase of 3 9 per cent. compared with last year. For the same countries, except Canada and India, the total production of barley is given as 137,242,000 qr., an increase of 0 1 per cent.; and that of oats as 297,227,000 qr., a decrease of 10 3 per cent.; and, with the further exclusion of England and Wales, Japan, Algeria, and Tunis, the production of rye in the remaining countries is estimated at 164,316,000 qr., a decrease of 8 8 per cent. compared with that of 1912. The revised estimates for Russia in Europe (63 Governments) place the production of wheat, rye, barley and oats at 84,314,000 qr , 101,162,000 qr., 55,508,000 qr., and 96,389,000 qr. respectively. Some estimates of the production of maize are now available In Spain the production is placed at 2,893,000 qr , which is about the same as in 1912; in European Russia (63 Governments) at 6,844,000 qr., compared with 9,285,000 qr.; and in the United States at 311,643,000 qr., compared with 364,448,000 qr.

The *Bulletin* further states that harvesting in *France* is proceeding under good conditions. In the case of wheat the bad weather at the beginning of July greatly hindered ripening and favoured the spread of disease. The condition of rye, barley, and maize was good, and of wheat and oats average on the 1st August. The condition of wheat, rye, barley and oats in *Italy* was very good. All crops in *Canada* benefited by the July weather; in the north-western provinces their condition remains excellent. In *Chile* the sowing of winter cereals was carried out, and germination took place under average conditions. The following are the areas sown in 1913–14.—Wheat, 1,153,490 acres, against 1,042,340 acres in 1912–13; barley, 111,150 acres, against 91,930 acres; and oats, 71,630 acres

Sugar Beet.—The crop is growing well in Austria, where the area is estimated at about 615,000 acres, but warmth is needed to develop the roots. The crop is in good condition in Hungary, but over-run in places by weeds, due to excessive moisture in the soil. On the 1st August the condition in Belgium was average, and in France, Italy and Spain, good. The production in Spain is estimated at about 1,060,000 tons, or practically the same as in 1912.

Germany.—The areas under the principal crops in Germany at the beginning of June, compared with those at the same date last year, are officially returned as follows (in acres and 1912 figures in brackets):—Winter wheat, 4,314,910 (4,273,382); spring wheat, 561,090 (482,878); winter rye, 15,546,131 (15,216,996); spring rye, 296,793 (265,350); spring barley, 4,084,913 (3,926,292); oats, 10,962,243 (10,834,739); potatoes, 8,427,717 (8,253,431); hops, 67,107 (66,720). (*Deutscher Reichsanzeiger*, August 26th.)

Prussia.—The yield of the cereals in Prussia is estimated as follows (in quarters):—Winter wheat, 10,565,000; spring wheat, 1,170,000; winter rye, 39,764,000; spring rye, 299,000; spring barley, 9,643,000, and oats, 40,832,000. (*Statistische Korrespondenz,* August 9th.)

On September 1st the condition of oats was 2·5, that of potatoes 2·6, and that of sugar beet 2·4 (2=good, 3=medium). Rye and barley were generally secured under favourable conditions. The quality is good, as a rule, and the yield large. Wheat is satisfactory on the whole. Owing to wet weather oats were frequently laid, and cutting was rather slow and carrying difficult. Potatoes are irregular. Early varieties are not yielding well, but the later varieties are expected to be better. On heavy low-lying soils disease is appearing. Sugar beet promises a good yield. Autumn cultivation is in arrears on account of the late harvest, and only in a few places have operations commenced. (*ibid., Sept. 4th.*)

Belgium.—A report issued by the Belgian Government, giving the condition of the fruit and vegetable crops on August 15th, states that a good yield of pears was still expected in South Limburg, the Herve district, in the neighbourhood of Yprès and Courtrai, and in some parts of Brabant; but elsewhere the yield promised to be poor or bad. Apples were satisfactory in West Flanders, the province of Antwerp, the district of Huy, in the north of the province of Namur and in west Brabant. Elsewhere, however, the crop was poor. The yield of onions was good in Flanders, around Namur and Tournai, and average in the province of Liège and around Mons and Brussels. (*H.M. Minister at Brussels.*)

Hungary.—The official report of August 18th estimates the yield of wheat at 19,243,000 qr, compared with 21,660,000 qr., the final estimate of 1912; of rye (and meslin) at 6,131,000 qr., compared with 6,315,000 qr.; of barley at 9,144,000 qr, compared with 8,414,000 qr.; of oats at 10,096,000 qr., compared with 7,872,000 qr.; of maize at 21,419,000 qr., compared with 20,609,000 qr.; of potatoes at 5,075,000 tons, compared with 5,296,000 tons; and of sugar beet at 4,783,000 tons, compared with 4,719,000 tons Heavy rains had hindered harvesting, and much damage was done by floods Except in the mountainous districts, most of the grain had been secured and threshing was in progress. The quality had suffered, much having sprouted. Maize had suffered from the cool, wet weather and much had turned yellow. It was feared that some would not ripen.

Russia.—H.M. Acting Consul-General at Odessa reports (August 26th) that wheat, barley, oats, and rye are all cut, and threshing is being carried on under favourable conditions. With good weather there is every probability that the yield of these crops in south Russia will be above the average; while barley and winter wheat promise to be of first-class quality. Sugar-beet promises well, but maize will only be fair. Ploughing for next season's crop is being carried on under excellent conditions, and it is said that a larger area will be planted with winter wheat than has ever been the case before.

India.—Since the issue of the Final General Memorandum on the wheat crop revised figures have been received from several districts. The total area is now given as 29,569,000 acres, and the production as 9,599,700 tons. (*Indian Trade Journal,* July 17th.)

United States.—The Department of Agriculture gives the following estimates of the yield of the principal crops, as indicated by their condition on September 1st (in bushels):—Spring wheat, 243,000,000, compared with 330,348,000, the final figures of 1912; oats, 1,066,000,000, compared with 1,418,337; barley, 168,000,000 compared with 223,824,000; maize, 2,351,000,000, compared with 3,124,746,000; and potatoes, 325,000,000, compared with 420,647,000. (*Dornbusch,* September 9th.)

Argentina.—The *River Plate Review* of August 15th states that during the previous week rains were general throughout the cereal zone and have done much good. In the district from Buenos Aires to the northward of Rosario ploughing for the maize crop was well in hand, and wheat, where sown, was just sprouting. Further north wheat was a few inches above the ground and the fields looked extremely good. From other parts of the Republic similar reports were received.

Hops.—The following particulars have been extracted from special reports received from H.M Consuls abroad:—

Germany—It is very difficult to express a reliable opinion on this year's crop The inclement weather of the past two months (July and August) was very prejudicial; and it may safely be assumed that scarcely half of last year's yield will be obtained in Baden and Alsace-Lorraine In the whole of Germany it is expected that the total yield will be about 300,000 cwts., or about three-fourths of last year's yield, from about 67,000 acres; Bavaria alone being expected to produce about 200,000 cwts., as compared with some 225,000 last year. But much depended upon the weather subsequent to the reports (August 20th); and these forecasts might be exceeded or the reverse accordingly. Stocks of the 1912 crop were practically depleted, and no reports of prices paid for this year's crop had yet reached the Consuls, although it was thought the probable range might be about £5 to £8 per cwt.

Austria—The yield in Bohemia will show a considerable decrease from last year, the total production being estimated at as little as 130,000 to 140,000 cwts, as against 344,000 in 1912, but favourable weather would probably have a considerable influence on this estimate. It was anticipated that the whole of Austria-Hungary would yield about 225,000 cwts, as compared with 443,000 last year.

Belgium—The hop crop is considered to be a good average, both in quality and quantity; and the production, if the weather remain favourable, is expected to be about 50,000 cwts.

Poland.—Cold weather had hindered the growth of the hops in Poland, but with favourable weather an improvement might be effected Picking would be a fortnight later than usual

United States.—The yield of hops in Oregon was expected to be about 225,000 to 230,000 cwts, compared with 211,000 cwts. in 1912, and 129,000 cwts in 1911. The yield in the State of Washington was estimated at about 70,000 cwts, compared with 59,000 cwts. last year, and that of California at nearly 200,000 cwts., compared with 209,000 cwts in 1912 The crop in Oregon and Washington was in very good condition, but in California it had suffered somewhat from the weather.

Potatoes.—The following particulars have been extracted from reports received from H M. Consuls abroad —

Holland.—The potato crop is estimated at between 102,000,000 and

104,000,000 bushels, which is fair in comparison with previous years, but dry weather and sunshine were badly wanted. Prices were being influenced by those prevailing in Germany, where prevalence of disease was reported, but were, on the whole, not above the average.

Germany.—The almost incessant rain which had fallen during the greater part of August had caused deterioration of the crop, and it was questionable whether subsequent fine weather would be able to repair the damage. Complaints of disease were general, but principally among early potatoes, the yield of which would probably be unsatisfactory. Late potatoes promised better, but even under the most favourable conditions it was likely that the crop in the whole of Germany would fall below that of 1912 (49,000,000 tons). In West Prussia and Pomerania, however, given good weather, good crops were expected. Germany would probably have to import potatoes to a greater extent than formerly, and prices would probably rise.

Belgium.—On the whole it was anticipated that the yield in Belgium would be above the average, and considerably larger than in 1912, while prices should be normal. In the Bruges district a much larger crop than last year's was expected, and there were scarcely any signs of disease. In the Ghent and Liège districts the yield would at least equal last year's, and the tubers were sound. Given favourable weather good crops are expected in the Ostend district.

Agricultural Conditions in England and Wales on September 1st.

The Crop Reporters of the Board generally refer to the dry weather of August as having been very favourable to harvesting operations throughout England and Wales; and, indeed, as rather improving the condition of the wheat and barley Corn cutting, which had commenced in early districts before the end of July, proceeded rapidly during August; and in most parts the bulk had been cut, and, a good deal carried, in the South, under favourable conditions.

Wheat is decidedly the best of the cereals, and often turning out a little better than anticipated a month ago. In many parts a fully average crop is being obtained, but, taking the country as a whole, it will probably prove to be about 2 per cent. below the average. Barley is also somewhat better than a month ago, and the probable yield is about 6 per cent. below average. Oats are the worst of the three cereals, and estimates of their yield have rather been reduced than otherwise. Straw is generally rather short. Beans and peas are being got in satisfactorily, but they are also short crops.

The potato crop is very generally healthy, but the tubers are very small, owing to want of rain, and the yield will almost certainly be below average, even although the recent rains should effect an improvement. Very few reports of disease have been received.

Both turnips (and swedes) and mangolds have suffered badly from the want of rain, especially the former. Turnips and swedes, according to appearances on the 1st September, look like being only four-fifths of an average crop; but they are not hopeless, although some fields have failed, and good rains would be by no means too late to effect great improvement. Most reporters, in fact, expected that the rain on the last two days of the month will be of great benefit to the roots.

Mangolds, although not so deficient as turnips, are nevertheless a poor crop and also in need of rain.

Prospects for hops have rather fallen off during the month; the persistent drought having been accompanied by persistent attacks of aphis, which necessitated very frequent washing. Generally speaking, this has been successful, and has probably saved many crops. Prospects are still much best in Kent, and worst in Hereford and Worcester; and the yield throughout the country will probably be 15 per cent. below average.

Apples, plums, and pears are all below average, particularly the last-named.

Pastures generally became very bare during August, and stock consequently hardly did so well as they should, as a rule. Water for stock became short in many districts, particularly in the North, but the rain at the end of the month remedied this. In some districts the milk-yield was low; reports to this effect being chiefly, although not exclusively, received from the home counties.

Labour on the whole was sufficient for requirements, but it is almost universally reported that this was due to the relatively restricted demand, consequent upon the very favourable conditions for harvesting operations.

Summarising the returns, and expressing an average crop by 100, the condition of the crops on 1st September indicated probable yields which may be denoted by the following percentages:—Wheat, 98; barley, 94; oats, 88; beans, 97; peas, 95; potatoes, 95; turnips and swedes, 80; mangold, 87; hops, 85.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on September 1st, 1913, certain diseases of animals existed in the countries specified:—

Austria (for the period August 14th—20th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 310 Hofe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period July 16th—31st).

Anthrax, Blackleg, Foot-and-Mouth Disease (52 outbreaks in 26 communes), Glanders and Farcy, Rabies.

Bulgaria (for the period June 14th—21st).

Glanders and Farcy, Rabies, Sheep-pox.

Denmark (month of July).

Anthrax, Glanders and Farcy, Swine Erysipelas, Swine Fever.

France (for the period August 9th—16th).

Anthrax, Blackleg, Foot-and-Mouth Disease (2,646 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period August 1st—15th).

Foot-and-Mouth Disease (30 infected places in 3 parishes), Glanders and Farcy, Swine Fever.

Holland (month of July).

Anthrax, Foot-rot, Glanders and Farcy, Swine Erysipelas.

Hungary (for the period July 31st—August 6th).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 247 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period August 4th—10th).
Anthrax, Blackleg, Foot-and-Mouth Disease (2,944 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period March 1st—15th).
Nil (no later returns received).

Norway (month of July).
Anthrax, Blackleg, Swine Fever.

Rumania (for the period July 29th—August 5th).
Anthrax, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (month of April).
Anthrax, Foot-and-Mouth Disease (3,302 animals in 52 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (no further returns received).

Spain (month of June).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (6,368 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of July).
Anthrax, Blackleg, Swine Erysipelas.

Switzerland (for the period August 18th—24th).
Anthrax, Blackleg, Foot-and-Mouth Disease (368 "étables" and Alpine-Pâturages entailing 13,701 animals, of which 83 "étables" and Alpin-Pâturages were declared infected during the period), Swine Fever.

Agricultural Labour in England during August.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in August.—

According to the returns received, although there was practically no interruption to outdoor employment from rain during August, the demand for labourers outside the regular farm staff was generally only fairly good. This was largely due to the partial failure of the root crops in many districts, though there was a much reduced demand for hoeing. In some districts, too, the corn harvest was late in beginning, while generally the crops were somewhat lighter than usual, the amount of labour necessary to gather them being further reduced by the extensive use which farmers, on account of the dry weather, were able to make of machinery.

The supply of extra labourers was, on the whole, rather below the demand. The insufficiency of men was, however, much less marked than in the previous month, while the supply was reported as more than sufficient for the demand in several districts. The counties in which there appeared to be the most marked scarcity of men were *Cheshire, Derbyshire, Kent,* and *Sussex.*

THE CORN MARKETS IN AUGUST.

C. KAINS-JACKSON

British Wheat.—Deliveries of the new crop were fair at some of the country markets from the 25th to 30th, and Mark Lane had a fairly representative show of samples on the 25th and 29th. The quality gave very general satisfaction, except for two disturbing features. There seems to have been an unusual quantity of new wheat secured in a more or less unripe state. Owing to comparatively sunless days, the crop ripened more slowly than was expected, and more irregularly, and the market surmise is that many farmers, having contracted for machines and labour from a specific date, were reduced to harvesting prematurely. The other disturbing feature is the prevalence of smut and bunt. This has particularly attacked the fine crosses of Canadian and English wheat, and it remains to be considered whether the very low average of summer sunshine this season has not been peculiarly inimical to the Canadian type, which has originated under cloudless summer skies. While these drawbacks of the season are too prominent to be ignored, the exchanges are finding the majority of samples heavier and finer than those of last year They find that the Square-head types have done well, and that weights of 64 and 64½ lb. to the bushel, if rare, are not rare enough to attract very special notice on any fair-sized market. Opening prices of the new crop ranged from the 25th to the 30th from 30*s.* for smutted and 32*s.* for partially unripe up to 35*s.* per 504 lb. sound red, 35*s.* 6*d* to 36*s.* sound white of the same weight, and 37*s.* and over paid for specially fine and heavy lots, 512 to 520 lb., either of white or red. Old wheat ranges from 33*s.* to 36*s.* for the majority of samples. There are a few parcels of old poultry wheat left, and these are held for 31*s.* to 32*s* per 448 lb.

Colonial and Indian Wheat—Canada has a late harvest this year, but with a good reserve of old wheat to dispose of, business has been brisk, and the new crop has not come into much discussion pending the working off of the old. Prices have been reduced fully 1*s* on the month, but this is not so much a sign of depression as of the natural readiness to accept a lower price where new grain is waiting its place at the elevators, and the clearance of the old is consequently somewhat hurried. Merchants are inclined to put the grading quality of the new about two points better than that of 1912—at least their ambition is to place good quantities of No. 2 where in September last they preferred not to guarantee above No. 4 This is a feature not yet fully developed, but it strikes a decidedly hopeful note. Indian wheat has fallen 6*d.* to 1*s.* per qr. owing to the liberal shipments and supplies. A good business has passed. Australian wheat has been fairly steady, its fine colour commending it to West End bakers and to the confectionery interest.

Foreign Wheat.—The United States found the new winter wheat to thresh out well, and before August was out were offering it for September shipment at 33*s.* per 480 lb. This price is rather a tempting one to buyers. The new spring wheat of the U.S. is a late harvest, and is rumoured to be a small one also. There are few offers to ship it,

and the price would be quite two shillings above that of the winter crop. Argentina has held wheat steadily, and 37*s*. to 38*s*. is the price obtained at our ports. Russia offers to ship rather freely. Business being entirely on sample, prices have a wide range; 33*s*. to 37*s*. may be mentioned; 35*s*. is accepted for 492 lb. Azima.

Supplies and Shipments.—Imports were heavy, and the demand being checked by close weather, the exchanges in the last ten days of August were somewhat spiritless The shipments of North America exceeded three million quarters, while those of Russia and Roumania were a little over a million. India was well represented with 878,000 qr. shipped, but the Antipodean countries are not expected to be large shippers after Midsummer, and on this occasion the exports of Argentina and Australia were 322,000 qr. and 234,000 qr. respectively. There were 2,050,000 qr. on passage on the 31st, which represents a decline of 350,000 qr on the cereal year

Flour —A single event may be said to have marked this trade. The Bakers' Exhibition opens early in September, and millers are wont to announce their prices for new flour thereat. This year they decided not to wait, but made a general and formal reduction of 6*d*. per sack at the London market of August 25th Oppressive weather during the last five trading days of the month made it difficult to do business, and the selling values of flour from new wheat cannot be said to be truly ascertained yet. The ordinary cash value of household flour from old wheat, home and imported, is now 27*s* 6*d* per 280 lb sack North America in August shipped 410,000 sacks, and there are 180,000 sacks on passage.

Barley —New winter barley came on sale at Mark Lane on the 11th, and had been shown at Chelmsford on the 8th and Canterbury on the 9th The six-rowed type has sold well at 28*s*. to 30*s*., and the four-rowed at 25*s*. to 27*s*. per qr. The spring barley was not in evidence during August to any extent justifying a regular quotation Imported barley lost ground during the month, as Russia pressed new crop on sale very persistently. The month's shipments were 1,782,000 qr from Russia, 252,000 qr. from North America, and 234,000 qr. from India. Holders point, however, to the fact of there being less than four hundred thousand quarters on passage to this country. Very free purchasing for the Continent is, of course, disclosed, and should this continue value might be expected to rally While recording this contention as reasonable, it is necessary to note that Russian shippers offer to place their barley on British quays in October and November at 22*s*. per 400 lb , a great decline on the cereal year.

Oats.—The great surplus of the River Plate is at last showing signs of giving out, and last month only 147,000 qr. were shipped. But the stocks at British ports of this kind remain heavy, and 17*s*. is accepted in order to effect sales Russia in August sent off 347,000 qr., and is asking 16*s*. for new crop for October shipment. The harvest is said to be large, and a special effort to ship before the ice impedes navigation is anticipated. North America in August shipped 172,000 qr.; the quality is very poor, and the British buyer shows little anxiety to purchase Total supplies on passage have fallen to 150,000 qr. The home crop has been slow in coming on sale, and for spring oats business could not be said to have opened in earnest before the close of

August. There has been, however, a steady and satisfactory business in winter oats, which come to hand just when they are wanted, and move off so promptly that the desirability of increased sowings is regarded by the markets as indicated. Cash terms have been usually 20*s.* for black, and 19*s.* for grey, but exceptional lots have fetched more.

Maize.—Trade in this staple has been of much interest, for the market has gained in tone, and prices for future delivery have advanced at the same time that Argentina has accomplished record shipments. For the period July 27th to August 30th they were 3,899,000 qr. The other shipping countries did not do much, their returns being: North America, 6,600 qr; Russia, 306,000 qr.; Roumania, 220,000 qr.; and Burma, 5,000 qr. The cause of maize for November and December arrival advancing to 25*s.*, and even higher, while spot value was given for arrived cargoes at 23*s.* 9*d.*, was to be found in the American crop reports. That the coming October maize harvest will show a great falling off from that of last October is accepted by all market frequenters, buyers as well as sellers, but beyond that opinions differ. Some buyers hold that stocks of 1912 maize are heavy and will modify the situation; American merchants, however, hold only half a million quarters. Not for many years have official figures of the American maize crop been awaited so eagerly. The decisive Bureau Return cannot be expected before October 11th (for the 1st). The area to deal with, about a hundred million acres, is enormous. August ended with 1,600,000 qr. on passage, the heavy total being due to one source alone—the colossal exports of Argentina.

Oilseeds.—The season, which closed on the 31st, was a very favourable one for buyers of linseed, and the consequent cheapness of oilcake has been a boon to agriculturists. Expectations of a like cheapness for 1913–14 are not high, for though Canada is credited with a useful export surplus, the United States are in a different position, and the Indian crop is not coming forward freely. Shipments for August were 205,000 qr. from North America, 355,000 qr. from South America, 329,000 qr. from India, and 5,000 qr. from Russia. At the end of the cereal year London-made linseed cake was at £8 per ton, against £9 2*s.* 6*d.* on August 31st, 1912, while Russian was at £7 10*s.*, against £8 15*s.*, and Indian at £7 8*s.* 9*d.*, against £8 16*s.* 3*d.* In striking contrast with linseed, good Egyptian cottonseed has gone to £10 per ton, and decorticated closed at £8 1*s.* 3*d.* per ton, a rise of 6*s.* 3*d.* on the cereal year. Soy bean cake, which is treated as oilcake, opened on September 1st, 1912, at £7 6*s.* 3*d.* per ton, and closed on August 30th, 1913, at £7 16*s.* 3*d.*

Various.—In the last days of August there came on sale, somewhat tardily, new winter beans at 32*s.* and 33*s.*, new maple peas at 35*s.* to 37*s.*, new winter tares at 50*s.* to 56*s.*, and new buckwheat at 32*s.* to 34*s.* per quarter. Throughout the month there was a small but steady sale of new rye at 26*s.* to 32*s.* per quarter, an unusually wide range of value. Demand for middlings, sharps, and bran was not large; but supply was quite small, so that prices showed a hardening tendency. Beet sugar, molasses, and the various proprietary fattening foods which depend on a saccharine basis, have all been obtainable at lower prices than usual, a circumstance of good import for the live stock interest.

THE LIVE AND DEAD MEAT TRADE IN AUGUST.

A. T. MATTHEWS.

Fat Cattle.—The month proved far too dry for the best interests of the grazier, not enough rain having fallen to give the grass a fresh start. The pastures turned brown in colour, and the herbage rapidly diminished. In every dry summer the same effects are visible. The cattle thrive well so long as there is a fair bite and water is abundant, but when the drought has lasted two months they have to work too hard for their living and cease to put on flesh. The prospect becomes alarming to farmers, and they begin to supply the markets with animals in quite second-rate condition and in larger numbers than they would do in normal weather. The inevitable result of these forced sales is lower prices, and this rule has been exemplified during the month just closed. There have been no very large extra supplies, and the demand has been steady, so that the decline which has taken place must be attributed almost entirely to the depreciated butchers' value of the cattle on offer. In the English and Welsh markets during August first quality Shorthorns averaged 8*s*. 9*d* per 14-lb stone, and 8*s* for second quality, against 9*s*. 2*d*. and 8*s*. 5*d*. in July; Herefords averaged 9*s*. and 8*s*. 4*d*., against 9*s*. 7*d*. and 8*s*. 9*d* ; Devons, 9*s* and 8*s* 3*d*., against 9*s* 4*d*. and 8*s*. 5*d* ; Welsh, 8*s*. 8*d*. and 8*s*. 1*d*., against 9*s*. and 8*s*. 1*d*.; and Polled Scots, 9*s*. and 8*s*. 7*d*., against 9*s*. 4*d* and 8*s*. 9*d*. per stone.

As the month closed, some rains which fell encouraged the graziers, and with rather fewer cattle at market there was a better tone in the trade, which will probably soon recover with more favourable weather.

Veal Calves.—The demand for fat calves remained very steady, and the supply being by no means excessive, values changed very slightly as compared with those of July Averages in over twenty of the most important markets were 9*d* and 8*d*. per lb for first and second quality.

Fat Sheep.—Supplies have been quite moderate, and the sheep have continued to come to market in very fair condition As regards actual numbers on offer, the fact that last year many important markets were closed for a considerable time owing to foot-and-mouth disease renders any comparison somewhat misleading. Sheep have not suffered in value through the drought to the same extent as cattle, but there has been some reduction. Averages work out as follows for the classes usually referred to in this article:—Downs, in over twenty leading English markets, averaged 8½*d*., 7¾*d*., and 6¼*d*. per lb., against 8¾*d*., 8*d*., and 6½*d*. in July; Longwools averaged 8*d*., 7*d* , and 5¾*d*., against 8¼*d*., 7¼*d*., and 6*d*.; prime Cheviots, 9*d*., against 9¼*d*.; and prime Cross-breds, 8½*d*., against 8¾*d*. per lb.

As with the cattle trade, the future of that for sheep during the coming months will be largely ruled by the weather. The roots offer but little promise at present, but there is plenty of hay, and even with half a crop of roots there will be no great sacrifice such as that of the disastrous year of 1911.

Fat Lambs.—The fall in the value of fat lambs amounted to about ¾*d.* per lb., the averages in over thirty markets in August being 9¼*d.* and 8¼*d.* per lb. for first and second quality. Some reduction in the value per lb. is to be expected as lambs become larger in size.

Fat Pigs.—Bacon pigs have remained at a premium, and values have formed a record for recent years. There was a further advance in the monthly average during August, and for prime small weights it was 8*s.* 9*d.* per 14-lb. stone, against 8*s.* 6*d.* in July, and 8*s.* 4*d.* for heavier weights against 8*s.*

Carcass Beef.—British.—In the London dead-meat market business has been slow, and more or less of a holiday character. Prices have been rather lower for all descriptions of beef. Scotch consignments have been small but quite sufficient for the demand, and in the third week, with heavier arrivals, there was a sudden fall of over ½*d.* per lb The quotations for British beef averaged as follows:—Scotch short sides, 4*s.* 10*d.* and 4*s.* 8*d.* for first and second quality; long sides, 4*s.* 6*d.* and 4*s.* 4*d.*; English, 4*s.* 4*d.* and 4*s.* 2*d.*; and Irish, 4*s.* 2*d* and 4*s.* 1*d.* per 8-lb stone.

Canadian Beef.—This trade has not been very important, but supplies have been sufficient to justify quotations Canadian sides averaged 4*s.* 3*d.* and 4*s.*, or about 2*d.* per stone less than July values.

Chilled Beef.—Movements in the chilled beef trade have been rather erratic, and although, like those for fresh killed, average prices were lower, the variations occurred in different weeks from those affecting British In the third week, when the latter declined sharply, chilled hinds advanced 4*d* per stone, but declined 6*d* in the last week, when British was firmer. Forequarters have been much steadier than hinds The averages for the month were:—Hindquarters, 3*s.* 6*d* and 3*s.* 2*d.*, and fores, 2*s.* 1*d.* and 1*s.* 11*d.* per stone

Frozen Beef—New Zealand hindquarters averaged 2*s.* 9*d* and 2*s* 7*d.*, and forequarters, 2*s* and 1*s* 11*d.* per stone, varying extremely little from week to week.

Carcass Mutton—Fresh Killed—Scotch and English mutton has met with a very irregular trade this month, and prices have been against sellers About the middle of the month supplies were unusually heavy, and there was great depression Prime Scotch tegs sometimes failed to move at 4*s.* 8*d* per 8-lb The averages were—Scotch, 5*s* and 4*s* 8*d*; English, 4*s* 6*d* and 4*s* 4*d*; and Dutch, 4*s* 3*d* and 3*s* 8*d*, representing a fall of ¾*d.* per lb compared with last month

Frozen Mutton—There has been nothing of special interest in this trade, but holders have had to lower their prices in sympathy with other branches of the trade New Zealand has averaged 2*s* 11*d* and 2*s* 6*d.* per stone, a decline of ¼*d* per lb compared with last month

Lamb.—Fresh Killed.—British lamb has been at a discount, and prices have fallen heavily. During the last three weeks really good quality has been selling at 7*d* to 7½*d* per lb

Frozen Lamb.—New Zealand carcasses have averaged 3*s.* 11*d.* and 3*s.* 6*d.* per 8 lb, a decline of 2*d.* per stone on the month

Veal.—Supplies of fair quality veal have been rather light, with very few really prime English calves on offer. Prices have been steady at 4*s.* 8*d.* to 5*s.* 4*d* per stone for English, with choice Dutch making about 4*d.* per stone more.

Pork.—Though regarded by so many people as quite out of season, a fairly large business has been passing in pork, and, since the first week, British pigs have been quotable at 4*s.* 8*d.* to 5*s.* per stone. Heavy sows have been unusually dear.

THE PROVISION TRADE IN AUGUST.

HEDLEY STEVENS.

Bacon.—Early in the month prices of all descriptions of bacon and hams were easier, and the tendency was for reduced prices during the whole of the month, causing hand-to-mouth dealings in all districts. A fall in prices in August is most unusual, as it is the month when dealers usually experience the largest demands and realise the highest prices, but with the continued high prices of pigs in all countries, and consequently extremely high prices of cured meats, many consumers have either discontinued eating bacon or are purchasing reduced quantities.

It is felt by many dealers that markets have been unduly depressed, and a reaction in prices may be looked for, especially if fine weather prevails in September, as it will be some time before any substantial reduction in the prices of pigs may be expected.

The arrivals from Denmark have been large, and prices for this description of bacon show a drop of about one penny per pound on the month, but for the next few weeks it is anticipated prices will be somewhat higher.

In America the demand keeps good, and with stocks at packing points below the average, prices show only a slight reduction. The number of hogs marketed has increased, and prices have been irregular, but on the whole lower, ranging during the month from $7.00 to $9.35, against $7.15 to $9.00 last year, and $6.45 to $7.90 two years ago. Arrivals from Canada continue small, and prices proportionately high.

Home products are cheaper in sympathy with the lower prices of imported lots. Curers still experience great difficulty in obtaining sufficient supplies for their requirements, and these conditions are expected to last for at least the next two months.

Cheese.—Although there have been fluctuations in prices during the month, by the end of the period quotations were about unchanged from those current at the opening, although the tone was firmer. Advices from Canada confirm the shortage in the make of cheese in that country, on account of the extremely dry weather in some of the cheese-making districts, and shippers are confident that further advances must take place. Rain has since fallen in those districts, but it is too late in the season to cause any great increase in the flow of milk.

The total shipments from Montreal and Quebec from May 1st to August 16th were 745,732 cheese, against 913,608 last year, and 955,650 two years ago. In a recent issue of the *Montreal Trade Bulletin* the editor writes:—

"The quantity of cheese to come forward from Canada this season, according to the most reliable sources of information, is to be short of last season by something over 6,000 tons. Increase of home consumption and very dry weather conditions are responsible for the shortage available for export. The stock of Canadian cheese in England is less than last year. The position for some months is therefore a strong one, and prices are likely to keep on a high basis, and may easily advance further."

There has been an increase in the consumption of cheese, but dealers do not operate freely, as they fear that present high prices cannot be maintained. The usual amount of contracting at this time of the year for winter requirements is not taking place, as grocers and others lost heavily last winter by covering their forward requirements at around present prices. Estimated stocks of cheese at the three principal distributing centres (London, Bristol, and Liverpool) at the end of the month were 209,000, against 226,000 at the same time last year, and 214,000 two years ago.

Estimated stocks of New Zealand cheese in London and Bristol at the end of the month were 11,000 crates (two cheese in crate), against 8,700 last year, and 2,600 two years back.

The demand for English cheese has been good, and prices have been very firm in sympathy with the high prices demanded for imported lots. A good average make is reported, with the exception of the West of England district, where the make has been less during the month on account of the dry weather.

Butter.—There has been a steady trade throughout the month, with prices a little higher at the end. The make in Siberia has been about an average for the time of year, but stocks held there are in excess of last year. In this country stocks of fancy butter are small, but there is plenty of secondary, which is difficult to sell.

In Canada the receipts into Montreal continue to show an increase over last season, being, from May 1st to August 21st, 307,494 packages, against 275,826 for the same period of last year. Shipments to this country were 730 packages, against 70 last year, and 67,484 in 1911.

New Zealanders ask from 116*s.* to 118*s.* c.i.f. for new season's factory outputs, which is considered too high for contracting.

In Ireland the make has decreased through dry weather and poor pasturage. Best creameries show an advance on the month, but other descriptions are pressed for sale.

PRICES OF AGRICULTURAL PRODUCE

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in August and July, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	August. First Quality.	August. Second Quality.	July. First Quality.	July. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots . .	9 0	8 7	9 4	8 9
Herefords	9 0	8 4	9 7	8 9
Shorthorns . .	8 9	8 0	9 2	8 5
Devons ..	9 0	8 3	9 4	8 5
Welsh Runts ...	8 8	8 1	9 0	8 1
	per lb.*	per lb *	per lb.*	per lb.*
	d.	d.	d.	d
Veal Calves ...	9	8	9	8¼
Sheep:—				
Downs	8½	7¾	8¾	8
Longwools . .	8	7	8¼	7¼
Cheviots	9	8¼	9¼	8½
Blackfaced . . .	8	7¾	8¼	8
Welsh	8	7½	—	7¾
Cross-breds	8½	7¾	8¾	7¾
	per stone.*	per stone.*	per stone *	per stone.*
Pigs:—	s. d	s. d.	s. d.	s d.
Bacon Pigs .	8 9	8 4	8 6	8 0
Porkers ...	9 0	8 6	8 10	8 4
LEAN STOCK:—	per head	per head.	per head	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk .	23 10	19 8	23 7	19 5
,, —Calvers	21 17	18 13	22 5	18 3
Other Breeds—In Milk ..	20 14	17 7	20 11	17 4
,, —Calvers	15 17	14 6	—	14 5
Calves for Rearing	2 11	1 19	2 14	2 1
Store Cattle:—				
Shorthorns—Yearlings	9 18	9 6	11 0	9 13
,, —Two-year-olds	15 4	13 0	15 7	13 7
,, —Three-year-olds	18 7	16 0	18 19	16 11
Herefords —Two-year-olds	16 17	14 6	17 9	15 2
Devons— ,,	15 2	13 8	15 9	14 7
Welsh Runts— ,,	15 6	13 15	15 5	13 16
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	36 7	31 1	37 3	32 9
Store Pigs:—				
8 to 12 weeks old	29 2	23 9	26 4	21 8
12 to 16 weeks old	38 3	30 7	36 11	30 1

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in August, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description	Quality.	Birmingham.		Leeds.		Liverpool.		London.		Manchester.	
		per cwt.		per cwt		per cwt		per cwt		per cwt.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF:—											
English ...	1st	59	6	57	0	55	0	60	6	56	0
	2nd	55	6	55	0	51	6	58	6	52	0
Cow and Bull .	1st	52	6	52	0	47	0	48	0	48	6
	2nd	47	0	48	6	42	0	43	6	43	6
Irish: Port killed	1st	—		55	0	55	0	59	0	—	
	2nd	—		53	0	51	6	57	6	—	
Argentine Frozen—											
Hind Quarters	1st	39	0	39	0	37	6	37	6	37	6
Fore ,,	1st	29	6	29	0	29	0	27	6	29	0
Argentine Chilled—											
Hind Quarters .	1st	49	0	48	6	46	6	49	6	47	0
Fore ,,	1st	30	6	29	0	29	0	29	6	29	6
Australian Frozen—											
Hind Quarters ..	1st	37	6	36	0	34	0	37	6	34	0
Fore ,,	1st	30	6	29	6	29	6	27	6	29	6
VEAL:—											
British	1st	—		66	0	78	6	74	6	74	6
	2nd	70	0	63	0	72	6	67	0	69	6
Foreign .	1st	—		—		—		78	6	—	
MUTTON:—											
Scotch	1st	—		—		—		70	0	72	6
	2nd	—		—		—		66	0	67	0
English	1st	67	6	73	0	70	0	63	6	67	6
	2nd	59	6	70	0	64	6	61	0	62	6
Irish Port killed	1st	—		—		70	0	—		—	
	2nd	—		—		64	6	—		—	
Argentine Frozen . .	1st	39	0	41	0	41	0	36	6	41	0
Australian ,, ...	1st	37	6	38	6	36	6	36	0	36	6
New Zealand ,, ...	1st	38	0	—		—		41	0	—	
LAMB:—											
British . .	1st	70	0	74	6	74	6	71	0	74	0
	2nd	66	0	69	0	66	6	66	6	68	0
New Zealand	1st	56	6	54	0	56	6	55	0	57	0
Australian	1st	53	6	—		53	6	—		53	6
Argentine ...	1st	51	6	51	6	50	6	—		50	6
PORK:—											
British	1st	72	6	70	0	71	6	70	6	74	6
	2nd	65	6	67	6	65	6	66	0	70	0
Foreign	1st	—		—		—		68	0	—	

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913.

Weeks ended (*in* 1913).	Wheat.			Barley.			Oats.		
	1911.	1912.	1913.	1911.	1912.	1913.	1911.	1912.	1913.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 4	30 5	33 2	30 5	23 11	33 3	28 6	17 0	20 7	19 10
,, 11 ...	30 8	33 1	30 3	23 10	33 0	28 4	17 2	20 8	19 2
,, 18	30 11	33 4	30 5	24 4	33 3	28 6	17 4	20 11	19 4
,, 25 ...	30 11	33 7	30 11	24 5	33 1	28 10	17 3	21 1	19 4
Feb. 1	30 9	33 8	31 1	24 5	32 10	28 11	17 5	21 3	20 2
,, 8	30 5	34 0	31 0	24 6	33 2	28 10	17 5	21 4	20 1
,, 15 .	30 3	34 4	30 9	24 7	32 10	29 1	17 6	21 7	20 2
,, 22 ..	30 2	34 6	30 11	24 9	32 8	28 8	17 7	21 9	20 7
Mar. 1 ..	30 0	34 1	31 0	25 0	32 0	28 6	17 5	21 6	20 4
,, 8 .	30 1	34 1	31 3	25 0	31 7	28 5	17 5	21 8	20 0
,, 15	30 1	34 0	31 1	24 11	31 2	27 11	17 6	21 8	20 2
,, 22	30 2	34 1	31 1	25 0	31 10	28 6	17 5	21 9	19 11
,, 29	30 3	34 4	31 3	24 11	30 3	27 6	17 5	21 8	19 7
Apl. 5	30 4	34 10	31 4	24 7	30 9	27 0	17 7	21 11	19 2
,, 12	30 3	35 4	31 3	25 2	30 2	27 8	18 3	22 1	19 2
,, 19	30 4	36 7	31 6	25 5	29 11	26 11	17 10	22 4	18 10
,, 26	30 11	37 10	31 8	25 5	30 4	26 7	18 3	22 9	19 3
May 3	31 4	38 1	32 2	25 7	30 2	25 11	18 6	23 1	19 6
,, 10	31 8	37 11	32 6	25 1	31 1	25 9	19 0	23 7	19 6
,, 17	32 6	37 8	32 10	25 4	31 2	25 4	19 2	23 7	19 9
,, 24 .	32 8	37 2	32 10	25 0	31 1	25 3	19 5	23 7	19 11
,, 31	32 5	36 10	32 7	24 10	30 0	26 1	19 5	23 9	20 1
June 7	32 4	36 11	32 10	25 7	29 11	26 2	19 7	24 0	19 8
,, 14	32 3	37 0	32 8	23 11	30 8	24 7	19 8	23 10	20 2
,, 21 .	31 11	37 5	32 8	23 9	30 8	23 10	19 10	24 0	19 8
,, 28	31 10	37 10	32 8	24 5	30 2	24 3	19 9	23 11	19 1
July 5	32 1	38 2	33 1	25 10	31 7	25 2	19 9	23 11	21 0
,, 12	32 3	38 3	33 4	25 10	30 2	25 10	19 11	24 1	19 4
,, 19	32 5	38 10	33 6	24 3	30 9	24 9	19 5	24 8	20 5
,, 26	32 5	38 9	33 10	23 8	30 9	24 1	19 7	23 4	20 8
Aug 2	32 0	38 4	34 1	24 4	28 6	24 5	18 2	22 2	20 3
,, 9	31 6	39 2	34 1	26 9	30 7	24 9	18 0	22 4	19 0
,, 16	31 6	38 2	34 3	27 8	28 3	24 7	17 10	21 8	18 7
,, 23	31 8	35 6	33 7	28 10	28 1	26 5	18 0	20 10	18 8
,, 30	31 7	34 10	32 7	28 4	28 6	29 0	18 3	20 8	17 10
Sept. 6	31 10	35 1	31 11	28 4	29 9	30 11	18 1	21 8	17 8
,, 13	32 0	33 5		29 0	29 0		18 5	20 5	
,, 20	32 4	32 7		29 11	29 6		18 9	19 10	
,, 27	32 6	31 7		30 5	29 9		19 1	19 5	
Oct 4	32 7	31 8		30 9	29 7		19 5	19 8	
,, 11	32 9	31 10		31 0	30 4		19 10	19 5	
,, 18 .	32 9	32 2		31 5	30 11		19 11	19 9	
,, 25	33 1	33 1		31 7	31 6		20 6	19 10	
Nov. 1 ...	33 4	33 4		31 10	31 10		20 8	20 1	
,, 8	33 4	33 1		32 7	31 11		20 11	19 11	
,, 15 ...	33 1	32 10		32 10	31 2		21 0	19 9	
,, 22	33 0	32 1		33 5	30 11		20 10	19 11	
,, 29	32 10	31 9		33 10	30 8		20 11	19 8	
Dec. 6 ...	32 9	31 0		34 0	29 11		20 9	19 6	
,, 13 ..	32 11	30 8		33 5	29 2		20 9	19 3	
,, 20	32 9	30 7		33 5	28 11		20 8	19 1	
,, 27 ...	33 0	29 10		33 4	28 6		20 7	19 2	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb., Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

—		Wheat 1912.	Wheat 1913.	Barley 1912.	Barley 1913.	Oats 1912	Oats 1913.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France	June	54 5	48 10	31 2	29 11	24 11	23 9
	July	54 4	48 4	31 3	29 9	24 11	23 8
Paris:	June	56 1	49 11	29 11	30 8	25 5	23 5
	July	56 9	50 2	30 6	30 8	25 0	24 11
Belgium:	June	39 4	36 4	31 0	28 10	26 9	22 8
	July	39 11	37 3	29 8	28 4	26 10	23 0
Berlin:	June	49 8	43 10	—	—	26 9	22 3
	July	48 11	43 7	—	—	26 0	22 9
Breslau:	June	45 5	38 9	—* 31 10†	—* 25 2†	25 4	20 4
	July	44 1	42 2	—* 30 1†	—* 26 0†	24 11	21 7

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*, the German quotations are taken from the *Deutscher Reichsanzeiger*

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of August, 1912 and 1913.

—	Wheat 1912.	Wheat 1913.	Barley 1912	Barley 1913	Oats 1912.	Oats 1913.
	s d.	s d	s. d	s. d	s. d.	s. d.
London	37 9	34 4	28 8	24 8	21 10	19 9
Norwich .	36 6	34 1	29 5	28 1	20 11	19 2
Peterborough ..	36 2	32 4	27 10	29 11	20 8	17 4
Lincoln .. .	37 1	32 2	30 4	28 7	21 6	18 5
Doncaster ...	38 4	32 7	—	—	24 0	19 0
Salisbury	38 2	32 9	25 6	24 6	21 3	19 4

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in August, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Bristol. First Quality.	Bristol. Second Quality.	Liverpool. First Quality.	Liverpool. Second Quality.	London. First Quality.	London. Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	14 0	13 0	—	—	13 6	12 9
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	111 6	108 0	109 6	106 0	110 6	107 6
,, Factory . .	102 0	96 0	101 0	93 0	101 6	96 6
Danish .. .	—	—	124 6	121 0	121 0	119 0
French . ..	—	—	—	—	111 6	106 6
Russian	104 0	100 0	103 6	100 0	100 6	96 6
Australian	110 0	105 0	—	—	109 0	106 6
New Zealand	—	—	—	—	—	—
Argentine	—	—	—	—	—	—
CHEESE :—						
British—						
Cheddar	76 0	67 0	73 0	71 0	75 6	70 6
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire . ..	—	—	68 6	64 0	74 6	69 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	65 0	63 0	65 6	63 0	66 0	65 0
BACON :—						
Irish (Green)	89 0	84 6	85 6	79 0	87 6	84 0
Canadian (Green sides)	81 6	78 0	79 0	75 0	82 0	80 0
HAMS :—						
Cumberland (Dried or Smoked) ..	—	—	—	—	129 0	122 6
Irish (Dried or Smoked)	—	—	—	—	123 0	114 0
American (Green) (long cut) ...	86 0	82 6	84 0	80 6	91 6	86 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	12 11	11 8
Irish	11 7	10 4	11 1	9 10	11 2	9 9
Danish	11 0	10 8	11 0	10 0	11 2	9 9
POTATOES :—	per ton.	per ton.	per ton.	per ton	per ton.	per ton.
Snowdrop .	105 0	95 0	78 6	71 6	91 6	81 6
Other First Earlies ...	101 6	90 0	66 6	60 0	86 6	76 6
British Queen	96 6	91 6	73 6	66 6	91 6	81 6
HAY :—						
Clover	—	—	100 0	80 0	123 6	100 0
Meadow . ..	—	—	—	—	100 0	86 0

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	AUGUST. 1913	AUGUST. 1912.	EIGHT MONTHS ENDED AUGUST 1913	EIGHT MONTHS ENDED AUGUST 1912.
Anthrax:—				
Outbreaks	36	37	381	566
Animals attacked	40	42	418	643
Foot-and-Mouth Disease:—				
Outbreaks	—	15	—	70
Animals attacked	—	121	—	442
Glanders (including Farcy):—				
Outbreaks ...	16	17	116	123
Animals attacked	20	23	297	232
Parasitic Mange:—				
Outbreaks	117	115	1,911	2,348
Animals attacked	173	187	3,851	5,094
Sheep-Scab:—				
Outbreaks .	5	8	129	173
Swine-Fever:—				
Outbreaks	242	191	1,716	2,218
Swine Slaughtered as diseased or exposed to infection ..	3,393	2,910	23,112	28,901
Tuberculosis:—				
Number of Premises notified	428	—	*2,008	—
Number of bovine animals notified as for slaughter	465	—	*2,203	—

* Since 1st May, when the Tuberculosis Order came into operation

IRELAND

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland*)

DISEASE	AUGUST 1913	AUGUST 1912	EIGHT MONTHS ENDED AUGUST 1913	EIGHT MONTHS ENDED AUGUST 1912
Anthrax:—				
Outbreaks ...	—	1	—	3
Animals attacked	—	1	—	3
Foot-and-Mouth Disease:—				
Outbreaks	—	8	—	24
Animals attacked	—	38	—	236
Glanders (including Farcy) —				
Outbreaks .	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	5	4	98	52
Sheep-Scab:—				
Outbreaks	23	—	374	262
Swine-Fever:—				
Outbreaks .. .	15	20	112	177
Swine Slaughtered as diseased or exposed to infection ..	100	93	667	1,482

SELECTED CONTENTS OF PERIODICALS.

Dairying and Food, General—

Winter Feeding of Dairy Cows, *A. S Grant.* [63.711.] The Management of a Dairy Farm, *J. Drysdale.* [63 70(04)] The Pollution of the Air in Commercial Dairy Byres, *J Hendrick.* [63 711.] Milk Records, *C Douglas* and *W Lennox* [63 711(b)] (Trans Highland and Agr. Soc Scot, 5th Series, Vol XXV., 1913)

Veterinary Science—

Chronic Diarrhœa in Cattle—Johne's Disease, *B Harvey Mellon* and *Patrick MacGinnis* (Dept Agr. and Tech. Instr. Ireland Jour., January, 1913) [619 2]

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THE JOURNAL

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OCTOBER, 1913.

THE CANTLEY BEET SUGAR FACTORY.

W. T. CHADWIN.

Secretary, British Sugar Beet Council

"IT was then our good fortune to secure a sample of the first beet sugar made in England under modern conditions, after twenty-three years of educational work in demonstrating the possibilities of its promotion from an agricultural and manufacturing point of view." Thus wrote Dr. Gustaf Schack-Sommer, one of the early and persistent protagonists of this movement, on the occasion of a visit to Cantley on November 12th, 1912.

In 1890, Mr. C. A. Gray, M.P., reported to the Central Chamber of Agriculture that he had attended a meeting to hear a paper read by Dr. Schack-Sommer on sugar beet cultivation, and it was stated at the meeting that about a quarter of a million sterling was ready for the support of the industry; the uninitiated may consequently wonder why so long a time elapsed before a sugar factory was established. There are many reasons for this, not the least important being perhaps the lack of any definite organisation provided with the means and the knowledge necessary to advise the growers of the earlier experimental crops of beets; to supervise the cultivation and the lifting, weighing, analysing, and other details; to classify results; and generally to bring into line all the parties interested in the movement. A Sugar Beet Committee of the Central Chamber of Agriculture was appointed in 1898, but this Committee had neither funds nor powers, and could only hold, as it were, a watching brief, and report to the Council of the Central Chamber any matters of interest. Consequently, although thousands of experimental

plots of beets were grown, and the Earl of Denbigh, the late Mr. Victor Millward, M.P., Dr. Schack-Sommer, and others spent much time and money on propagandist work, the lack of uniformity in the results obtained, and in the opinions and estimates put before the public, tended rather to confusion than conviction. It was not until 1910 that the Sugar Beet Committee of the Central Chamber of Agriculture was resolved into the British Sugar Beet Council, with an executive and a definite programme. Another chief reason why progress has been slow, was, and still is, the difficulty of bringing the factory financier and the farmers into accord, the former not being willing to take the risks of a factory without having adequate and continuous supplies of beets guaranteed, and the growers refusing to enter into agreements even when their tenures permit, until they see the outward visible sign of a market. Nor, apparently, did either the capitalists or moneyed landowners care to undertake combined beet estate and sugar factory projects, which would obviously overcome the latter obstacle in the way of progress. Another source of trouble, probably, has been the putting on the market of sugar companies without the necessary steps having been taken to secure a successful issue.

Meanwhile the representatives of Continental groups interested in sugar were investigating the possibilities of establishing the industry in England, and amongst them was Mr. Ali Cohen, who made proposals to farmers, chiefly in Norfolk, to induce them to grow sugar beet on a commercial basis. Mr. Cohen acted in conjunction with the Norfolk Chamber of Agriculture, and in his first season, 1910, was only successful in getting the farmers of the district to cultivate about 30 acres of sugar beet, for which he offered 17*s.* per ton free on rail. In a letter to the *Standard* in March, 1911, Mr. Cohen stated that these 30 acres yielded a net produce of 370 tons of roots, having an average sugar content of 15·7 per cent. He went on to say that "having regard to the unfavourable conditions under which the crop was grown, the result may be considered eminently satisfactory, and affords ample proof that if beet were planted and grown on an industrial scale there might be anticipated in normal seasons, on a very conservative estimate, a crop of 15

tons per acre, with an average of 16 per cent. sugar." In 1911 the terms offered to the farmers were improved, with the result that some 250 acres were secured. At a meeting held in the Agricultural Hall, Norwich, on March 4th, 1911, Mr. Cohen said: "I will accept this crop at 20*s*. per ton delivered free on quay or harbour, Great Yarmouth, Lowestoft, Lynn, or other convenient harbour. I will provide free seed, and will send over specialists to do the seeding with our own machinery, provided you give free transport of this to the next farm or railway station. I further will provide free supervision from the moment of preparing the land for the seeding till the crop is lifted. I will further assist you at our own cost with extra hands for the lifting and handling of the crop, which will not cost more than 25*s*. per acre."

The year 1911 will long be remembered as one of the driest and sunniest years on record; turnips, swedes, and mangolds were in many instances a total failure; yet the sugar beet did well except on very light thin soils. The writer inspected many of the Norfolk crops in October of that year, and was much impressed by their appearance. The precise weights grown were not disclosed, but without doubt the yield in some cases was not less than 15 tons per acre. At all events, the experimental work of the two years 1910 and 1911, coupled with what was already known about yields of sugar beet in this country, satisfied Mr. Cohen's principals as to the chances of the industry being successfully established in Great Britain, and steps were taken to promote an English company. In July, 1911, the promoters approached the writer with a request that he would introduce English directors for a definite proposal which they put before him, to acquire the entire share capital and outstanding debentures of a Dutch company owning three fully-equipped sugar works in Holland, and to establish works in the United Kingdom. As the properties and accounts had been reported upon by English firms of position, and as the necessary capital had been secured, he put the matter before the Chairman of the British Sugar Beet Council, Mr. G. L. Courthope, M.P., who, after due inquiry, accepted the chairmanship of the Company. Associated with him on the Board are Sir John Millbanke, Bart., V.C., Mr. H. W. Sillem, Mr. Alex. McNab, and Mr. J. P. Van Rossum

(the managing director in England). The Company was registered at Somerset House in December, 1911, under the title of the Anglo-Netherland Sugar Corporation, Limited. These particulars may be of interest in view of the widespread belief that the undertaking is not an English concern.

On January 27th, 1912, a largely attended meeting was held in the Corn Exchange, Norwich, with Sir Ailwyn Fellowes in the chair, and the announcement was made that the Company would forthwith commence the erection of a factory at Cantley, which would be ready to deal with the sugar beet crop in the autumn, and farmers were informed of the terms of the cultivation agreements that were in course of preparation. This announcement was very well received; an office was established in Norwich; contracts were entered into; and the total area finally arranged to be grown amounted to 3,366 acres.

The following is the form of contract adopted in 1912:—

I, the undersigned, ...
of .. ..
undertake to grow Beetroots from your seed in the year 1912 on not less than acres of land situate at
in the Parish of in the County of
and hereby agree to sell and deliver, as below specified, the crop so cultivated to you upon the terms and conditions specified in the Conditions hereto annexed and at the price of 23*s*. per ton of 20 cwt. net of clean Roots delivered at the Factory at Cantley, or 21*s*. per ton on railway truck within 15 miles of the Factory, or on barge provided by the Corporation.

Dated the day of 1912.

Signed .

The Conditions above referred to.—1. The price specified above is understood to be net for the number of tons of clean Roots delivered in accordance with the terms of these Conditions, and will be paid by cheque on the London City and Midland Bank at Norwich within eight days after delivery of the entire crop agreed to be sold.

2. *The Land*. The land contracted for must be dunged and ploughed not later than April 1st.

The Company will on request, as far as its engagements permit, assist by practical demonstration and advice through its representatives, free of cost to the grower, in the preparation of the land and by supervising the growing of the crop. For these purposes free access must be given to the Company's Agent when required.

3. *Seed*. The Company shall provide all the seed necessary at the rate of 5*d*. per lb , and the whole of the seed supplied must be used.

The use of other seed is forbidden, and the Company may refuse to accept Beetroots grown with other seed. The sowing of the seed may be done by the Company, but the grower undertakes to supply all necessary labour and machinery on the land to be sown, free of cost to the Company.

4. *Labour.* The Company will, at the grower's request, use its best endeavours to provide expert labour to assist in or supervise the lifting and cutting of the grower's crop, but the request must be made in writing not later than July 15th. Such expert labour is to be at the grower's expense, he paying only the cost price to the Company.

5. *Roots.* The Roots must be delivered in good condition, undamaged by frost, clean of dirt, neither rotten nor hollow, and cut off flat where the lowest leaves are found.

6 *Weight.* The Beetroots will be weighed at the Factory. The grower or his agent may be present at, and check, the weighing.

The weight of dirt in each delivery will be calculated by dividing each delivery into lots of 6 tons; a ½ cwt. sample will be taken out of each 6-ton lot, and washed. The average difference in weight on all the samples before being cleaned and after will fix the average amount of dirt over the whole delivery on any day.

7. *Delivery.* The Roots are to be delivered free of all cost to the Company:—

(*a*) At the Factory.

(b) In railway trucks, at the station of . ...

(c) In lighter or wherry, at the quay at ....

(*d*) On the quay at . ...

Delivery of the Roots must be made at the place above specified regularly in four approximately equal quantities on or before the 8th October, 21st October, 8th November, and 21st November, subject to any special instructions which may be given by the Company.

Should the grower be in default in delivering any portion of his crop by the 21st November, the Company is to be entitled to refuse to accept the portion of the crop not delivered by that date.

The Company will pay a premium for each ton net of clean Beetroots delivered in accordance with these Conditions prior to 1st October, 1912. The amount of the premium will be decided and notified to the grower not later than 31st August.

8. *Sugar Pulp.* The Company will reserve for the growers for their own use an amount of dry Sugar Pulp in proportion to the amount of Beetroots each has delivered, at a preferential rate to be fixed by the Company for all growers; written notice by the grower of his requirements must be given to the Company, at its works, before the 31st May, 1912.

9. If any question or dispute should arise between the Company and the grower with regard to the meaning of these Conditions or the rights of either party hereunder, the matter in question or dispute shall be decided by a sole Arbitrator, to be selected and appointed by Mr. . . ..
of .. ..

and the decision of such Arbitrator shall be final and binding upon both the Company and the grower.

To...

of . ...

The Anglo-Netherland Sugar Corporation, Limited, hereby accepts the contract by you to sell to the Corporation the Beetroots to be grown by you on acres of land, a copy whereof appears above.

For the ANGLO-NETHERLAND SUGAR CORPORATION, LIMITED.

Managing Director.

Financial Facilities for Approved Growers.—The Company is prepared to open accounts with approved growers, who will be allowed credit from time to time up to such amount as the Company may determine, but the maximum amount of credit will not exceed £4 per acre under cultivation with beetroots.

The grower will thus be entitled to purchase his seed, tools, artificial manures, &c., from the Company, which the Company will sell to him at cost price, and be debited with the cost thereof in his account with the Company.

Interest at the rate of 5 per cent. per annum will be charged on any amount for the time being standing to the debit of the account. An official statement of his account will be rendered to the grower every month.

The Company will deduct from the price of the roots delivered by the grower, before payment, the amount standing to the debit of his account and interest thereon to date.

The 1913 contract differs in several particulars from that for the previous year, and reads as follows:—

I, the undersigned, . . .

of.. . . ..

undertake to grow Beetroots from your seed in the year 1913 on not less than acres of land situate at in the County of and hereby agree to sell and deliver, as below specified, the crop so cultivated, to you upon the terms and conditions specified in the Conditions hereto annexed, and at the price of 22*s.* per ton of 20 cwt. net of clean roots delivered at the Factory at Cantley.

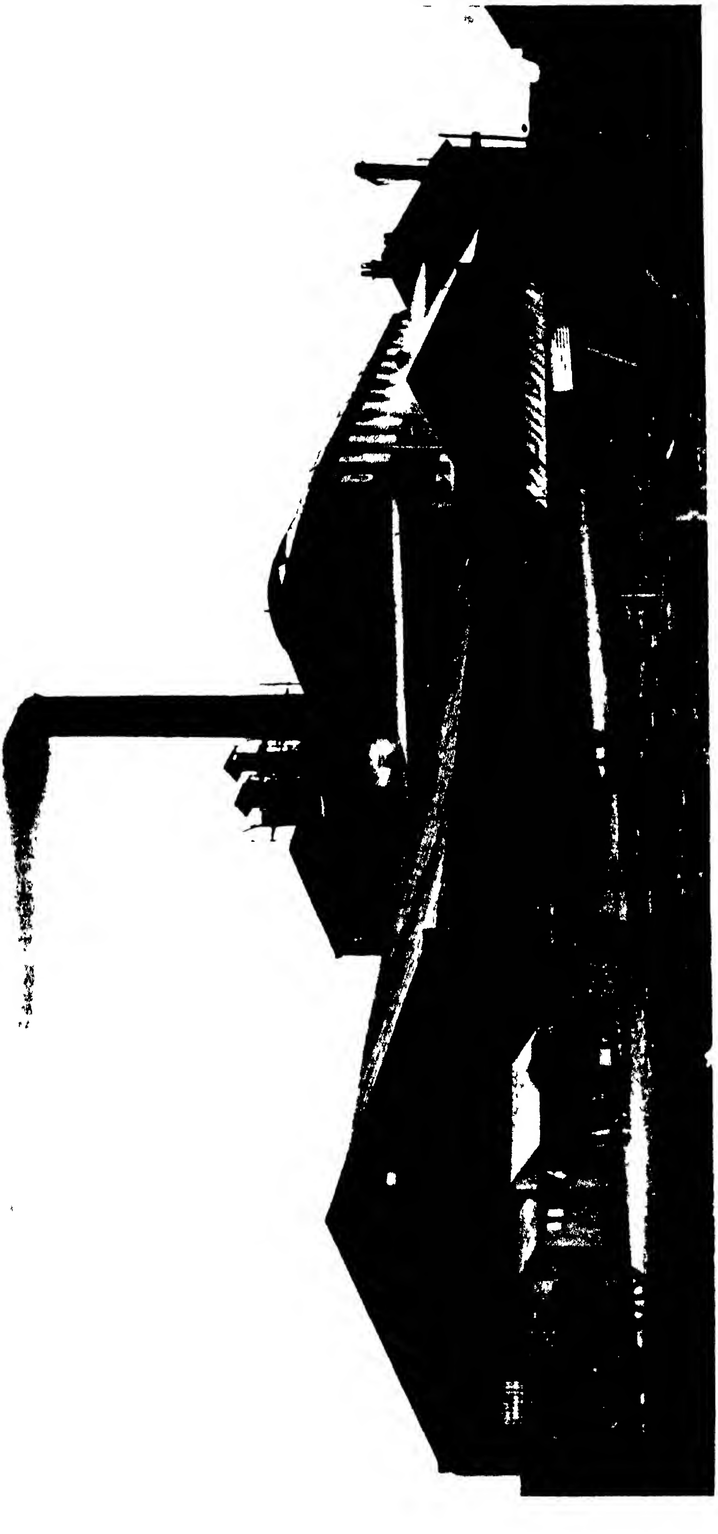
Dated the day of 1913.

Signed . . . ..

The Conditions above referred to.—1. The price specified above is understood to be net for the number of tons of washed roots delivered in accordance with the terms of these Conditions, and will be paid by cheque on the London City and Midland Bank at Norwich within eight days after delivery of the last consignment.

2. *The Land* The land contracted for must be mucked (if any is applied) not later than 1st April.

The Corporation will on request, as far as its engagements permit,



give advice through its representatives, free of cost to the grower, in the preparation of the land and in the cultivation of the crop.

3. *Seed.* The Corporation shall provide all the seed necessary at the rate of 5*d.* per lb., and the whole of the seed supplied must be used. The use of other seed is forbidden, and the Corporation may refuse to accept Beetroots grown with other seed.

4. *Roots.* The roots must be delivered in good condition, undamaged by frost, clean of dirt, neither rotten nor hollow, and cut off flat below the lowest leaves.

5. *Weight.* The Beetroots will be weighed at the Factory. The grower or his agent may be present at, and check, the weighing.

The weight of dirt in each delivery will be calculated by dividing each delivery into lots of 6 tons; a ½ cwt. sample will be taken out of each 6-ton lot, and washed. The average difference in weight on all the samples before being cleaned and after will fix the average amount of dirt over the whole delivery on any day In the event of the tare for dirt exceeding 20 per cent., any extra charge for washing incurred by the Factory will be debited to the grower concerned.

6. *Delivery.* The roots are to be delivered at the Factory free of all cost to the Corporation.

Delivery of the roots must be made at the place above specified regularly in four approximately equal quantities on or before the 8th October, 21st October, 8th November, and 28th November, subject to any special instructions which may be given by the Corporation.

Should the grower be in default in delivering any portion of his crop by the 28th November, the Corporation is to be entitled to refuse to accept the portion of the crop not delivered by that date.

When the Corporation desires to commence its campaign in the month of September a premium will be paid for each ton net of clean Beetroots delivered in accordance with these Conditions prior to 1st October, 1913 The amount of the premium will be decided and notified to the grower not later than 31st August.

7. *Sugar Pulp.* The Corporation will reserve for the growers for their own use a quantity of dry Sugar Pulp in proportion to the amount of Beetroots each has delivered (1 ton of Pulp for every 10 tons of Beetroots) If when signing this Contract the grower gives the Corporation notice in writing that he desires to exercise the above option, the price of the Pulp will be £5 5*s.* per ton at the Factory. If, however, the grower fails to give the above notice, the Corporation will still reserve for him all the Pulp produced from the Beetroots delivered by him, on notice in writing that he so desires, up to 30th June, 1913, but in this event the grower will be charged the current market price.

8. If any question or dispute should arise between the Corporation and the grower with regard to the meaning of these Conditions or the rights of either party hereunder, the matter in question or dispute shall be decided by a sole Arbitrator, to be selected and appointed by

Mr. . . . .

of ....

and the decision of such Arbitrator shall be final and binding upon both the Corporation and the grower.

To . . ..

of .. . .

The Anglo-Netherland Sugar Corporation, Limited, hereby accepts the contract by you to sell to the Corporation the Beetroots to be grown by you on acres of land, a copy whereof appears above

For the ANGLO-NETHERLAND SUGAR CORPORATION, LIMITED.

Managing Director.

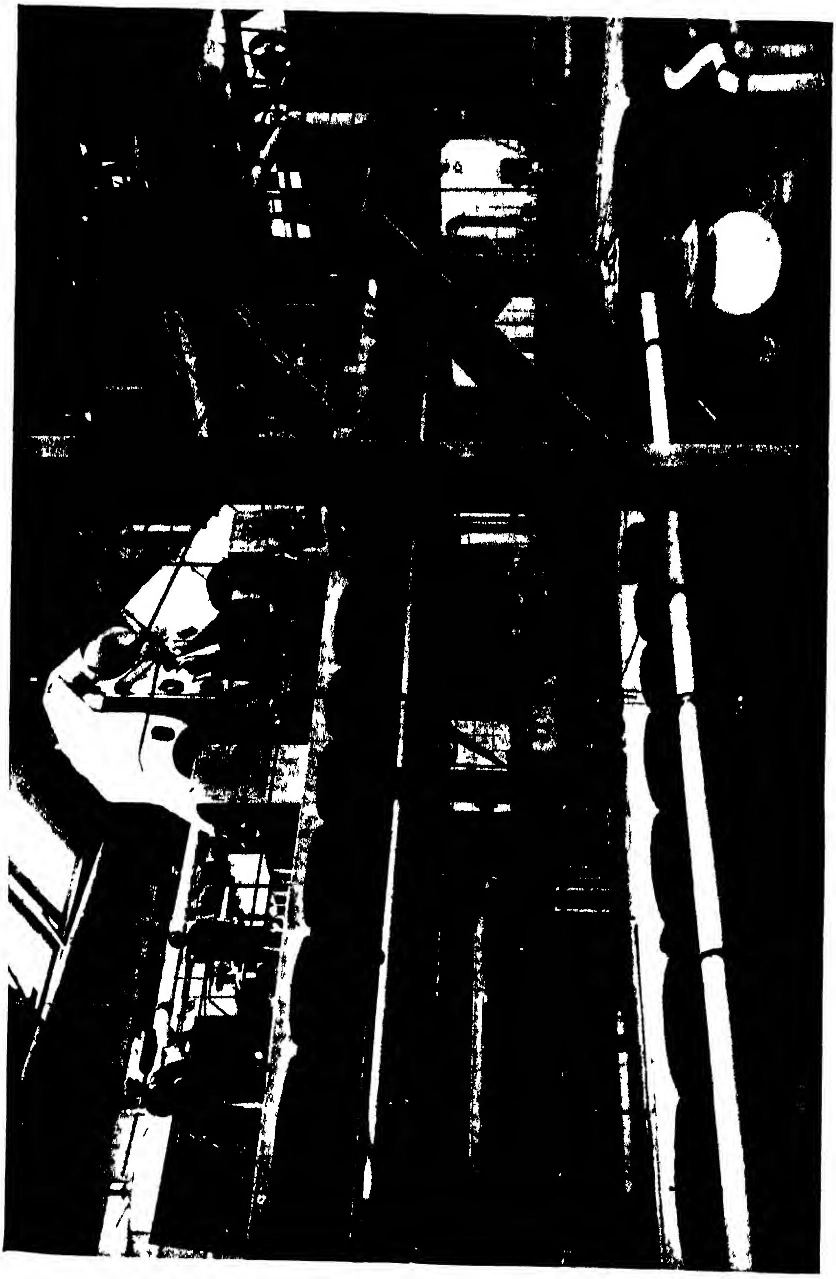
Financial Facilities for Approved Growers.—The Corporation is prepared to make advances to approved growers, on and after 15th July, but the maximum amount of advances will not exceed £4 per acre under cultivation with Beetroots.

Interest at the rate of 5 per cent. per annum will be charged on any advances for the time being standing to the debit of the grower.

The Corporation will deduct from the price of the roots delivered by the grower, before payment, the amount standing to the debit of his account and interest thereon to date.

For 1914 the introduction of some further modifications is being considered.

In order to meet the desire of a number of the less enterprising agriculturists, and to popularise the growing of sugar beet throughout East Anglia, an arrangement was entered into under which some farmers practically sublet their land to the Company at a fixed price irrespective of the quantity of beet raised thereon. Under this scheme the farmers undertook to do all the cultivation up to and including the preparation of the seed bed, drill seed, and sow artificial manures provided by the company, horse-hoe the crop four times if required, and provide, at 1*s*. per ton per mile, the haulage to rail or barge. The Company found the seed, artificial manures, supervision, and special labour for singling and lifting the crop. The price to be paid for the use of the land and the work to be done by the farmer was £6 per acre. It is obvious that under this method the farmer's interest in the crop is reduced almost to vanishing point, and he has no inducement to study the cultivation or to improve his system of husbandry. It is to be hoped that agriculturists will realise this drawback to what at first sight might appear to some to be a plausible idea, and will in their own interests discard the system in favour of the ordinary contract. The writer is informed that there are signs of this view being taken, and hopes are con-



fidently entertained that in 1914 the acreage grown under this form of agreement will be substantially reduced and will eventually disappear.

Building the Factory.—The site selected for the factory is nearly 40 acres in area, and comprises the land between the Great Eastern Railway and the River Yare, just eastward of Cantley Station approach road, almost midway between Norwich and Yarmouth. It has, therefore, road, rail, and river communication. Work was commenced at the earliest moment, and in April, 1912, the Chairman stated at the statutory meeting that "satisfactory progress is being made with the erection of the factory and other buildings adjacent thereto." Soon afterwards, unfortunately, the effect of the coal strike began to be felt, and delay was caused in the delivery of the plant manufactured in England. The machinery and apparatus contracted for on the Continent, however, came to hand in good time, and up to August the work proceeded well. Then trouble began in earnest on account of the extraordinary rainstorms, culminating in the unprecedented visitation on August 26th, when nearly nine inches of rain (equal to the average for between four and five months) fell in the day and night. Those who visited Norfolk immediately afterwards witnessed a scene never to be effaced from their memory. The factory seemed to be in the very centre of the storm, and suffered severely; the river overflowed its banks and flooded the whole site; the rains washed down mud and débris which filled all the excavations, and at one time it was feared that the factory foundations would be undermined. Traffic had to be suspended on the railway; bridges and culverts were destroyed; roads were rendered impassable; and for the moment chaos reigned supreme. Notwithstanding all this, the boilers were in steam, and trial runnings of the engines, &c., were made by the end of October, and the factory campaign commenced, as has been stated, on the 12th November.

The Factory Buildings.—The factory buildings are well and substantially constructed, with steel framing filled in with red brickwork. They consist of a main building containing the engines, dynamos, and sugar-making machinery; a boiler house extending along a large portion of the north side of

the main building; a lime-kiln adjacent to the boiler house; and a "granulator chamber" and a sugar store at the west end of the main building. Detached from this principal block are the offices, laboratory, and other buildings, the whole forming a compact installation said to comprise all the best modern improvements in beet sugar factory construction and equipment. The main building (Figs. 1 and 6) is 197 ft. long, 99 ft. wide, and 62 ft. high, with a ground floor and two gallery floors; this arrangement admits of the middle of the building being open to the roof, affording good light and ventilation, and giving an impression of spaciousness and freedom, although there is no waste of room. Here are housed nineteen steam engines and four petrol engines, aggregating just upon 2,000 horse-power; two dynamos and nine motors, besides beet slicers, conveyers, infusers, vacuum pans, centrifugals, and other apparatus for the manufacture of sugar by the Steffen process, which is the process in use here. The boiler house is 152 ft. long, 51 ft. wide, and 30 ft. high, accommodating a range of five high-pressure and five low-pressure Babcock and Wilcox water-tube boilers. The flues from these connect with a fine shaft 170 ft. high and 9 ft. internal diameter. From the western end of the main building extends the sugar store and "granulator chamber" (under one roof), 166 ft. long, 68 ft. wide, and 38 ft. high.

It is not proposed to consider the details of sugar manufacture, and it is therefore not necessary to describe all the apparatus, machinery, and processes, beyond saying that the infusion method invented by Carl Steffen has been adopted by the company. By this method considerably less water is required, and consequently less waste water has to be disposed of. On the other hand, the whole of the available sugar is not extracted, and it is claimed that the feeding value of the residual pulp is greater than that of the pulp from the diffusion process; the cost of recovery of the last 2 per cent. or 3 per cent. of sugar may be prohibitive when the price of sugar rules low.

All the steel work of the factory was supplied and erected by a local firm; the rest of the constructional work was carried out by the Company; the boiler work was undertaken by well-known English makers, and some portion of the sugar

Fig. 3. Unloading Sugar Beets from Trucks at Factory Sidings

Fig. 4. Washing by Hand Sample Sugar Beets to ascertain Deduction for Tare

making machinery was provided and fixed by Scotch engineers.

Although at first it was thought that the floods and indifferent season had not injuriously affected the beet crop as a whole so much as might have been expected, yet the series of untoward events resulted altogether in the commencement of the campaign being delayed until nearly the middle of November, and in only 25,200 tons of beets being passed through the factory. No one therefore, outside the management, can be in a position to form any opinion of the future from the actual results of the last campaign.

The present season, so far, is much more promising: the factory has been put into thorough working order, and a much larger tonnage of roots will naturally result from the increased acreage, the improved knowledge of cultivation, and the more favourable climatic conditions.

The Position of Farmers.—The Chairman of the Corporation has informed the writer that some 4,500 acres of beets are being grown for the factory this season, and have done particularly well in comparison with other root crops in the same localities. The average yield is estimated at 14 tons per acre, and some fields are expected to run up to quite 20 tons. It is pleasant to learn that splendid wheat and barley crops have been grown on last year's sugar beet land.

As regards the agricultural side of the question it would appear that last year many growers, even with the advantage of expert advice and supervision, were quite incapable of rising to the occasion, and the difference between the best and worst results was much greater than it should have been. Of the total acreage of sugar beet grown, 1,000 acres, in round figures, were cultivated by men who worked intelligently in conjunction with the company's experts. The yield from these averaged about 12 tons of washed roots per acre. This, for a first season, which was not a good one, and considering that beet growing was not decided upon when the autumn preparation was done, is satisfactory. On the Company's own land, cultivated by its own experts, the weight ran as high as 18 tons, and averaged rather over 15 tons per acre. The highest net weight actually paid for last season, of which we have particulars, was 19 tons 9 cwt. per acre. The remainder

was largely grown by farmers who stood out for the fixed price per acre, and the yield averaged only about 6 tons, which fully justifies the observations already made in regard to such an arrangement.

The cultivation was designedly spread over a large area, and although the Great Eastern Railway Co. gave special facilities and rates, the cost of getting the beets to the factory was in many cases a serious item.

Details kindly furnished by some of those who grew beets under the ordinary contract showed that their autumn and spring cultivation, including seed and artificial manures, but labour only on dung, cost, per acre, from £4 10*s*. 4*d*. to £5 9*s*. 3*d*.; lifting and topping, £1 5*s*. to £1 10*s*.; cartage, &c., £2 to £3 10*s*. 11*d*.; and rent and rates, £1 5*s*. to £1 15*s*. The total costs, exclusive of cartage, ranged from £7 5*s*. 4*d*. to £8 9*s*. 3*d*.

Labour.—The demand for reasonably efficient or adaptable labour was, of course, considerable, and it very soon became clear that the local sources were quite inadequate. Even with the assistance of the Government Labour Exchanges only a small proportion of the agricultural hands that could have been employed were forthcoming. Further, the hoeing and singling of sugar beet require to be done more carefully than is customary with our root crops, and it was found that many of the men who were taken on were disinclined to adapt themselves to any change of method, and so a good deal of trouble was caused that seemed unnecessary, but perhaps was inseparable from the first stage of a new agricultural industry. It was always intended to bring over from the Continent a certain number of experienced beet-farm hands to act as instructors, but the Company was forced to go far beyond this, as the field operations could not be neglected or delayed, and altogether from time to time during the season a large number of men were brought over from Holland. Only a small portion of the necessary housing was available for this considerable addition to the ordinary population, and special arrangements had to be made, and local camps were formed by the erection of marquees and temporary iron buildings, the adaptation of barns, &c., for domestic accommodation, all of which, of course, cost a good deal of time and money.

FIG. 5.—THE SUGAR BEETS BEING FLOATED ALONG FLUME.

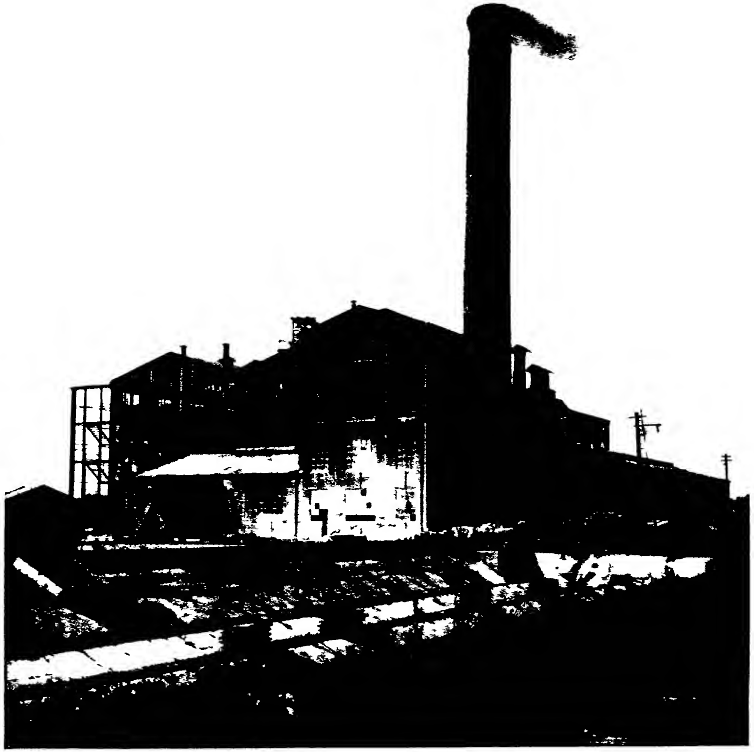


FIG. 6.—CANTLEY BEET SUGAR FACTORY.

The expense involved was a very heavy item, as not only had the men brought over from Holland to be paid 5*s*. per day, but each party brought their own cook with them at their employers' expense, their board and lodging cost approximately 11*s*. per man per week, and the transport out and home came to about 35*s*. per man. It is consequently manifest that this was no case of cheap or "sweated" foreign labour. On the other hand, the value of these men in the field in comparison with Englishmen was much greater on account of their long experience, and there seems no reason why our own people, when equally skilled, should not earn relatively high wages. The value of this crop as a means of improving agricultural employment will be appreciated when it is stated that during the present season the Company has engaged about 400 English and 350 Dutch labourers.

Several facts of interest emerge from the results of last year. The costs put forward by the British Sugar Beet Council are shown to be ample, and the yields and profits very moderate; heavy expenditure does not of itself necessarily ensure a correspondingly large yield, but judicious cultivation and adaptation of methods to soil and season will give satisfactory returns, the large number of indifferent crops support the view we have always held, that a sugar beet installation should comprise a large acreage of land managed on scientific progressive lines. In this last connection, the following quotation from the Report of the British Sugar Beet Council for 1912, indicating the view of a great agricultural authority, is worthy of serious attention.

"The Hon. E. G. Strutt, in his Presidential Address, put before the Surveyors' Institution tabulated results of mixed farming extending over eighteen years, during which period the average net profit from mangold was 18*s*. 3*d*., whilst in five out of the eighteen years there was an actual loss. These figures on such authority effectually dispose of the mythical profits claimed for mangold. His figures further show a net profit on white straw crops averaging £2 10*s*. 6*d*. per acre, but the permanent pastures yielded only 7*s*. 11*d*. per acre. Mr. Strutt says: "These figures show that corn crops generally have, on the whole, paid their way satisfactorily, and if the alternative cultivation could be made equally

profitable, arable farming would be a fairly successful venture."

"Sugar beet unquestionably supplies an alternative cultivation, even more profitable in itself than the corn crops, one that also enhances the value of those crops, and consequently one which should make arable farming not a 'fairly' but a very successful venture. The large demand for labour and the opportunities afforded for earning higher wages must help materially towards the solution of the rural depopulation and housing questions."

In view of the expressions on every side of an intense desire to improve the lot of agricultural labourers and farmers, and to make rural life happy and attractive, it seems curious that more than twenty years should have been spent in talking about, and often disparaging, so promising a means to the attainment of this end as the sugar beet industry. The Press, public speakers, and politicians of every shade of opinion, have voiced the need for the betterment of the conditions of country life, and all these have frequently pointed to the great possibilities of sugar beet and its success all over the world, yet the initiative has been left to others, and the first factory has been erected chiefly through the enterprise and confidence of strangers.

Acknowledgments are due to the Chairman, Managing Director, and Secretary of the Anglo-Netherland Company for their courtesy in furnishing information.

EXPERIMENTS IN THE APPLICATION OF ELECTRICITY TO CROP PRODUCTION.

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In a former number of this *Journal* (Vol. XVII., April, 1910, p. 16) an account was given of some of the more recent attempts which have been made to apply electricity on a large scale to stimulate crop production. These experiments, being conducted on private estates and under conditions where the crops had to be grown and marketed at a profit, could not be carried out in such a way as to answer many of the ques-

tions which arise in connection with such a new agricultural method. During the last year a generous grant made to me by the Board of Agriculture and Fisheries from the Development Fund has enabled me to attack some of these problems with an equipment which should prove adequate for the investigation. Even the first season's work has shown how essential a great deal of preliminary work is in this subject, and already results have been obtained which make it necessary to regard the experiments previously recorded in a new and more critical light. An account of these investigations, with details of the experimental methods employed, will appear elsewhere, but as inquiries are continually being received which show that many other workers are interested and active in this field of work, it is thought that an account of my recent work, with special reference to its bearing upon the results of field trials, may prove of interest to readers of this *Journal.*

The difficulties that lie in the way of the application of electricity to the direct stimulation of crop production are of two kinds, one series of problems needing investigation in the laboratory, and the other in the field. There are so many processes at work within the plant, of vital importance to it, which may be altered in quantity and quality by the application of electricity, that only laboratory investigations of an extensive kind can help us to understand the effect of placing a high-tension discharge above the plant, and of the resultant increase of the electric current through the plant to the ground. Thus in this country and elsewhere, at the present time, work is in progress upon the effect of such an electrical discharge upon the respiration of plants, on their synthesis of food, on the rate of evaporation of water-vapour from the leaf, and on many allied problems.

These inquiries are not yet sufficiently advanced to form a suitable topic for discussion here, but it must be understood that it is only with their solution that we can arrive at a satisfactory answer to our main problem, which is whether electricity can under any circumstances be profitably used as a means of increasing the production of any of our staple crops.

At the same time there are many problems connected with

the practical application of overhead electric discharge to plants which can only be solved by experiments in the field, and if the general question is to be answered at an early date it is desirable that work on these problems should advance equally with the experiments in the laboratory. Experiments in both these branches of work are in progress at the University of Leeds—the laboratory work with the aid of a Lodge-Newman high-tension discharge apparatus, and the field experiments at the University experimental station, the Manor Farm, Garforth, where land has kindly been placed at my disposal by the courtesy of the Yorkshire Council for Agricultural Education. It has been impossible at Garforth to make estimates of the crop yields; the land is not suitable for the purpose, and in any case the crops would have been too much damaged in the prosecution of the experimental electrical work, which has necessitated constant trampling over the growing plants. As, however, crop yields must form our ultimate test of the practical value of the method, they must obviously be obtained, and this has been possible through the co-operation of Miss E. C. Dudgeon at Dumfries.

At the commencement of 1912 Miss Dudgeon had already in operation a full-size Lodge-Newman high-tension apparatus, whilst a similar installation, through delays caused partly by the coal strike, was not ready for use at Garforth until the beginning of June. It proved, therefore, a great advantage to be able to conduct the trials directed to determine the effect upon yields at Dumfries, where the willing assistance of Miss Dudgeon and of Mr. Cameron, the farmer upon whose land at Lincluden Mains the crops were grown, rendered it possible for me to have arrangements made exactly as I desired.

It is proposed to describe the apparatus used in these large scale trials, to outline the problems which the experiments suggest, to discuss the bearing of the year's work at Garforth on these problems, and finally to review the results of two years' work at Dumfries.

Apparatus Employed in Field Experiments.—In connection with experiments intended to test on a large scale the economic possibilities of this new system there are two main problems to consider, the apparatus to be employed and the comparison

of the treated crop with the normal yield. One has first to find the best apparatus to apply electrical stimulus to the crop, and then to obtain a plot of land bearing a similar crop under otherwise similar conditions, which is not subjected to the stimulus. The yields obtained from this control crop can then be used, if the necessary precautions are taken, as a check upon the yields obtained from the experimental plot, and enable us to determine whether the yield of the treated crop is above or below the normal.

In the older experiments, which had to be carried out upon a large scale, the great difficulty was to obtain a sufficient supply of high-tension electricity. With modern apparatus this presents no difficulty as long as sufficient precautions are taken to prevent leakage. This apparatus, which I have termed for brevity the Lodge-Newman apparatus, has been described on several previous occasions, and quite a brief account of it will be all that is required here.

Current is taken from any ordinary continuous supply, such as the mains from a direct current dynamo or a storage battery, and is interrupted by a break (the mercury jet form is usually employed and works quite satisfactorily) before being passed through the primary of a large induction coil acting as the transformer. A current of some two or three ampères at one hundred volts, passed through the primary, gives an adequate output of high-tension electricity, but this high-tension discharge, when it leaves the secondary of the coil, is alternating in character.

The alternating discharge from the coil is then led through a series of valves, devised by Sir Oliver Lodge, before it reaches the field spark-gap. These valves, which enable the discharge to pass across only in one direction, eliminate the alternations, so that at the field spark-gap there is a difference of potential between the two poles of the gap, constant in sign though pulsating in character. One of the poles of the gap is connected to earth, the other is connected to the overhead system of wire. As the wires extend over several acres of land they provide a considerable amount of capacity for the transformer to charge, and therefore very much steady the potential of the system.

The difference of potential between the two sides of the field gap, as roughly measured by allowing a spark to pass

between two round metal spheres, remains fairly constant, varying only with changes in the insulation of the outside field of wire (due to moist insulators and supporting poles), with changes in atmospheric conductivity and in the current supplied to the primary. In the various experiments carried out with this apparatus during the last seven years the potential of the overhead system employed, as measured at the spark-gap, has varied between some 60,000 volts and 100,000 volts.

From the spark-gap the discharge is led out to the overhead field by a heavily insulated wire, running out through the wall of the high-tension shed through a silica tube supported on porcelain insulators.

The system of overhead wires is borne upon larch poles, crowned by specially constructed large insulators, in which the leakage, due to moisture condensed at the surface, is counteracted by an oil cup on the inner protected surface. The charged wires do not touch the insulators, but are suspended at some distance from them by means of some special insulating medium—rods of ebonite, chains of porcelain insulators, and other methods have at various times been used. If care is taken over this question of insulation, especially in obtaining adequate insulation where the high-tension wire leaves the shed and where the network is supported by the pole over the field, then it is possible to keep the overhead network continuously charged to very high tensions, such as 100,000 volts.

The overhead wire network itself consists of wire of two gauges (up till now galvanised iron wire has been used); the larger wire (No. 11) runs in two parallel strands across the strip to be electrified, and at every ten yards the thin (No. 24) wire spans the space between them, and from this wire, owing to its thinness, the high-tension discharge is continually leaking down to the plants beneath. As these wires will stand considerable strain, they can be drawn taut by means of the usual strainers, and as the poles stand some 16 feet above the surface of the ground, the wires, in spite of their inevitable sag, remain well out of the way during all farming operations.

In all experiments up to the close of last year (1912) in which this apparatus has been used, the control to the electri-

fied plot has consisted simply of a similar piece of land in the same field, but without this system of wires overhead. As we shall see later, this must now be regarded as an inadequate control.

Experimental Problems.—As was pointed out in the earlier article in this *Journal,* it is very necessary during the course of the experiment to ascertain that effective discharge from the overhead system is taking place. This may be done by simply holding an insulated wire beneath the overhead charged wire and ascertaining whether it collects a charge. The experiments this year at Garforth have shown, however, that this method of ascertaining the amount of discharge is totally inadequate, and it is necessary to have some means of comparing quantitatively the amount of discharge taking place in one part of the field with that occurring in another.

Before proceeding to show, by reference to the Garforth experiments, how essential this is, a few of the other outstanding difficulties needing experimental elucidation may be briefly enumerated.

The actual strength of discharge, as determined by the number of thin wires above the crop and the potential they are raised to, is not decided by experimentally determined necessities of the plant; the current supplied is that which proves most practically convenient. The sign of the discharge may be inadvisedly chosen. Positive discharge is used, but negative has never been adequately tried since the time of Lemstrom's experiments with far inferior apparatus. The length of time such an electrical discharge should be applied, and the most suitable time of day or season, are problems awaiting elucidation, which will be obtained probably through laboratory experiments. Furthermore, for the proper control of such a discharge system many data are required as to the different climatic conditions, whilst several field observations in earlier years have suggested that under different soil conditions, especially different soil moisture conditions, different effects would be produced in the plant as the result of the same electrical treatment.

It is hoped that, by the time experiments on these points have shown how a large scale apparatus can best be applied, the experience gained at Garforth will enable one to decide

exactly how a large scale trial must be carried out to solve definitely the economic questions at issue.

The Garforth Experiments.—As soon as the apparatus was in working order at Garforth an attempt was made to settle a very important point, hitherto neglected. In all the recent work on the subject, no direct attempt seems to have been made, as the result of the measurements taken in the field, to determine the exact current which was being delivered to the plants by the overhead electrical discharge. Until this point was settled no laboratory results could be applied with certainty to field problems, because there was no guarantee that the electrical conditions in the two cases were comparable.

This is not the place for a detailed description of methods; suffice it to say that after trying several methods to obtain the required electrical measurements, the most practical and useful apparatus proved to be an electrometer,* with two different pairs of aluminium leaves giving a range of from about 80 to 800 volts. For determinations of atmospheric potential the electrometer was simply connected to a flame collector mounted on an ebonite stand; the electrometer itself stood on the field on a level glass plate, and care was taken that the insulated wire between electrometer and collector was not allowed to approach too close to any blades of grass.

For the determination of the current density in the air the flame collector was replaced by a flat metal collector of known area and a condenser of known capacity connected up with the electrometer, the outer cases of both electrometer and condenser being connected to earth. The average time required for the electrometer to take its full charge and discharge to earth was then taken, and from these data, knowing the capacity of the whole system to be charged, it was possible to calculate the strength of the current per square centimetre at the point where the metal collector was placed in the air. The result would, of course, be only approximate; no guard-ring was used round the metal collector, and certain other precautions were not taken, but it would be reliable for the order of magnitude of the current, and in view of the variability in the strength of the current

* Supplied by Spindler and Hoyer, Gottingen.

due especially to the air movements in the open fields, this was all that was required.

When these data were obtained it was possible to compare the electric current in the field under the discharging wire with that present under the normal atmospheric conditions. There is always, of course, some atmospheric current, as the atmosphere above the earth shows a marked potential gradient, the surface of the earth itself being practically always negative compared with the atmosphere alone.

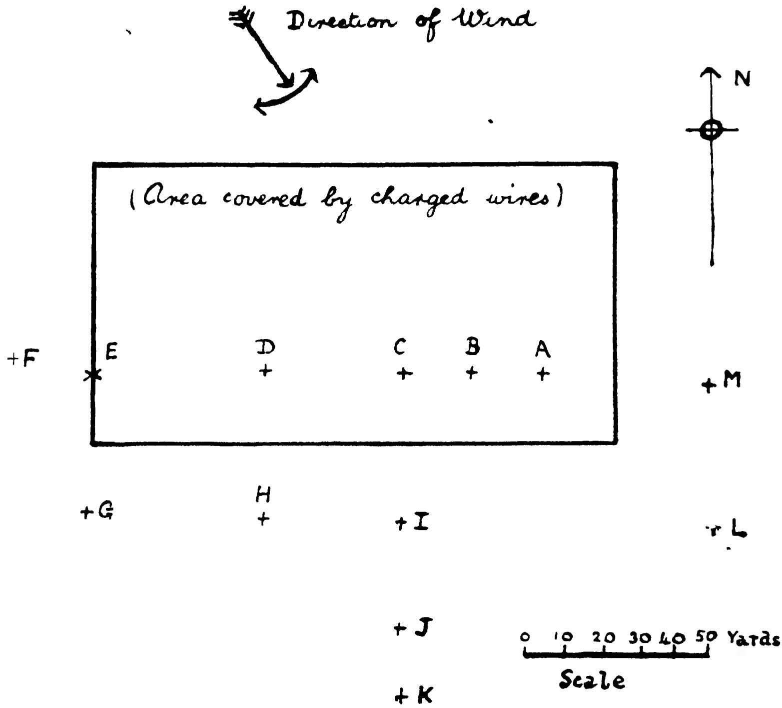


DIAGRAM SHOWING POINTS WHERE CURRENT WAS DETERMINED WHEN A LIGHT WIND WAS BLOWING

This natural flow of positive electricity downwards through the air is of the order of 10^{-16} ampère per square centimetre in absolute electromagnetic units. In the conditions obtaining under the wires the current was increased to a value of from 10^{-12} to 10^{-11} ampère per square centimetre.

That is to say, the current, under the electrical treatment, is raised to some 10,000 times its normal value. Considered in the light of energy supplied to the plant for its possible use, it is still a remarkably low figure, and suggests that if effect is produced by such treatment it is to be looked for in

the more direct utilisation of resources of energy already available under the stimulating action of the electric current.

As soon as the current under the wire had been determined, measurements of the current in other parts of the field at varying distance from the charged overhead wires were made. These determinations soon showed that the effect of the discharge could by no means be looked upon as restricted to the area under the wires, but that on a still day a current at least a thousand times the normal was to be found at a distance of some thirty to forty yards out from the wires, while on a windy day, even though the wind was comparatively light, the current travelled out away from the wires down the wind for quite unexpectedly long distances. As this point is of considerable importance in view of the necessity of having the control plot in somewhat close conjunction to the electrified area, so as to have similar conditions of soil and exposure, a diagram is given on which some points are shown where the current was determined on a day on which a light wind was blowing (Diagram, p. 589).

The approximate value of the current obtained at these points was as follows:—

A	6×10^{-11} amp /cm.^{2} sec	F	Less than 10^{-13} amp /cm ^{2} sec	J.	2×10^{-11} amp /cm ^{2} sec.
B	8×10^{-11} ,, ,, ,,				
C	10×10^{-11} ,, ,, ,,	G	4×10^{-11} ,, ,, ,,	K	1×10^{-11} ,, ,,
D	9×10^{-11} ,, ,, ,,	H.	3×10^{-11} ,, ,, ,,	L	2×10^{-11} ,, ,,
E	4×10^{-11} ,, ,, ,,	I	4×10^{-11} ,, ,, ,,	M	4×10^{-11} ,, ,,

From these figures it will be seen that *a control area unaffected by the discharge cannot be obtained within hundreds of yards on the leeward side of the electrified area.*

We have here a result that is quite capable of explaining the numerous discrepancies and contradictions to be found in the literature of field experiments on this problem. Certainly such data render it absolutely necessary to regard the matter as entirely unproven in either direction until further experiments have been carried out with genuine controls for purposes of comparison.

Reviewing previous experiments from this point of view, it may be pointed out that in the Evesham experiments on wheat, in which some positive effect has been obtained in six years out of seven during which the experiment has been continued, the electrified and control areas are large and lie side by side, so that it would only be compara-

tively strong winds in one direction that would carry the discharge over the whole of the control area. In 1911, when the wheat gave no increase under treatment, spring wheat was grown in a very dry season. The average yield was only 16 bushels to the acre, while the unelectrified plot was unusually small and lay to the east of the electrified plot, with another electrified area to the north of it.

In the Balmakewan experiments which Mr. Low is conducting, the electrified area has been in the centre with the control area lying around it on all sides, so that the wind must practically always carry discharge on to some portion of the control area.

The Dumfries Experiments, 1911 *and* 1912.—In the experiments at Dumfries in 1911 four different varieties of potatoes were grown in the experimental area. The rows of potatoes ran north and south, and the northern half of the strips was under electrification. The yields obtained are given in the following table.

Experimental Plot.

Variety.	Tons	Cwt	Qr	Lb	Remarks.
Ringleader—					
Seed size	6	19	—	—	—
Under 1¼ inches	1	2	—	—	—
Total	8	1	—	—	No disease
Windsor Castle—					
Seed size ..	10	19	1	4	—
Under 1¼ inches	—	15	0	24½	—
Total	11	14	2	0½	No disease
Golden Wonder—					
Seed size ...	7	19	2	—	—
Under 1¼ inches	—	15	0	24½	—
Total	8	14	2	24½	No disease
Great Scot—					
Seed size	11	1	1	15	—
Under 1¼ inches	—	10	2	6	—
Diseased	—	4	0	6½	—
Total	11	15	3	27½	Diseased 4 cwt. 6½lb.

Control Plot.

Variety.	Tons.	Cwt.	Qr.	Lb.	Remarks.
Ringleader—					
Seed size	4	13	—	—	—
Under 1¼ inches	1	4	—	—	—
Total	5	17	—	—	No disease
Windsor Castle —					
Seed size	8	18	0	19	—
Under 1¼ inches	—	19	2	9	—
Total	9	17	3	0	No disease
Golden Wonder—					
Seed size	7	5	1	7	—
Under 1¼ inches	—	17	1	5½	—
Total	8	2	2	12½	No disease
Great Scot—					
Seed size	9	6	2	20	—
Under 1¼ inches	—	16	3	19½	—
Diseased	—	2	2	24	—
Total . ..	10	6	1	7½	Diseased 2 cwt 2qr 24lb

The increased yields under electrified wires were as follows (per acre):—

Variety	Tons	Cwt	Qr.	Lb
Ringleader	2	4	0	0
Windsor Castle .	1	16	3	0½
Golden Wonder . .	—	12	0	12
Great Scot	1	9	2	20

It will be seen that in all cases the electrified crop has given a better yield than the control, though the difference varies in amount. In this case it is perhaps significant that the field in which the experiment was conducted is somewhat shielded from the north wind by a long belt of trees some two hundred yards further north. Winds from the north seem also to be much less frequent in occurrence than winds from any other quarter. In the light of these facts the 1911 results may

possess real significance, but only further experiments can decide the point.

In 1912, when the experiments were planned in the spring, the extent to which the current could spread from the electrified area was not appreciated, and the plots were arranged rather with a view to neutralise any errors due to inequality of ground than to allow for any leakage of electric current down-wind. The experiments were carried out in another field, further removed from the belt of trees so that they were open to the influence of winds from any direction.

To avoid, as far as possible, errors due to soil and exposure, the plots were arranged so that two corners of the four acres under treatment were electrified, the other two being left as controls. It will be seen that this plan meant that in whatever direction the wind blew it would carry current from an electrified area over one or other of the control areas. In the course of the year comparatively little more current can have reached the electrified area than the control, if comparison is made with the ordinary atmospheric current, which is probably ten thousand times smaller in intensity than the current reaching any part of this experimental area.

To avoid additional sources of error no organic manure was used in the ground, but an artificial fertiliser, a complete potato manure, was spread by means of a distributor.

When the crop was being raised, the plots were carefully divided into sections of one-tenth of an acre in extent, the potatoes placed in sacks on the field, and the sacks from each section weighed and entered separately. The figures for these tenth-acre plots show that there is practically no difference in the yields from the electrified and control areas. Unfortunately, such a result cannot in the circumstances be at all decisive, as, for the reason given above, the electrified and control areas probably have to be regarded as virtually both electrified areas.

The immediate problem is the provision of a genuine control area, near enough to the charged wire to be under similar conditions to the electrified area as regards soil, climate, and exposure. This is by no means an easy matter, but experiments at present in progress make one hopeful that partial success may be obtained by placing a netting of

galvanised iron wire, ten or twelve feet high, between the control area and the charged wire. The netting will need to be of comparatively close mesh, but for the purposes of a critical experiment the difficulties in the way of erecting such a netting can readily be overcome. A more serious difficulty is that even with this barrier inserted, preliminary observation suggests that it will still be necessary to stop the discharge whenever a strong wind is blowing from the electrified area towards the control.

With new precautions on these lines the experiments are being continued at Garforth and Dumfries in the present year, and as the results of the laboratory investigations are also now becoming available, it is hoped that the year will see some advance made towards the solution of the main practical problem as to whether the discharge under carefully controlled conditions can really produce sufficient increase in the growth and yield of a crop to make it suitable for extended application.

NARCISSUS FLIES.

R. STEWART MACDOUGALL, M.A., D.SC.

THE LARGE NARCISSUS BULB FLY.
(*Merodon equestris,* Fab.)

ABOUT 180 years ago Narcissus bulbs attacked by a larva were brought to the celebrated entomologist, Reaumur, who bred out from the bulbs the fly *Merodon equestris.* The native habitat of this species seems originally to have been the countries of south Europe bordering on the Mediterranean. From this region the insect was carried in bulbs further north. About 1840 complaints of its damage to bulbs were received in Holland, and some time afterwards in England. Verrall recorded the fly in England in 1869. There is no doubt that the larvæ are very frequently distributed in infested bulbs; such bulbs reach England from the Continent, and the pest has also in this way been carried to New Zealand and America.

Merodon equestris is well known in some parts of Ireland. It is widely distributed over the whole of England. In Scotland I have had the grubs in bulbs from as far north as

Elgin, and also from Edinburgh; other Scottish localities recorded in the Royal Scottish Museum are Aberdeen, Perth, Dumbarton, and Dumfries. In different parts of the country great destruction of Narcissus bulbs has been reported, and the adult flies have now and again been caught in large numbers.

Plants Attacked.—In addition to bulbs of the genus Narcissus the larva has been found in bulbs of Amaryllis (Adams), Habranthus (Chittenden), Vallota (Chittenden and Theobald), Eurycles (McLachlan), Lilies (Wilks), and Galtonia (Thèobald). A most interesting point is the finding, by Theobald, of the larvæ at work—at Wye and in Devon—in the bulbs of the Wild Hyacinth (*Scilla nutans*). Partly on this Theobald bases his opinion that *Merodon equestris* is native in England.

The damage is done by the larva tunnelling and feeding in the bulb. According to the nature of the attack the bulb may be so spoiled that it rots away completely. In other cases flowers and weakened plants may be produced, but no new bulbs.

It is often difficult to say without opening the bulb that a Merodon grub is present within, but in typical cases, when the grub has been at work for a considerable time, the infestation can be recognised by the bulb "giving" on being squeezed between finger and thumb.

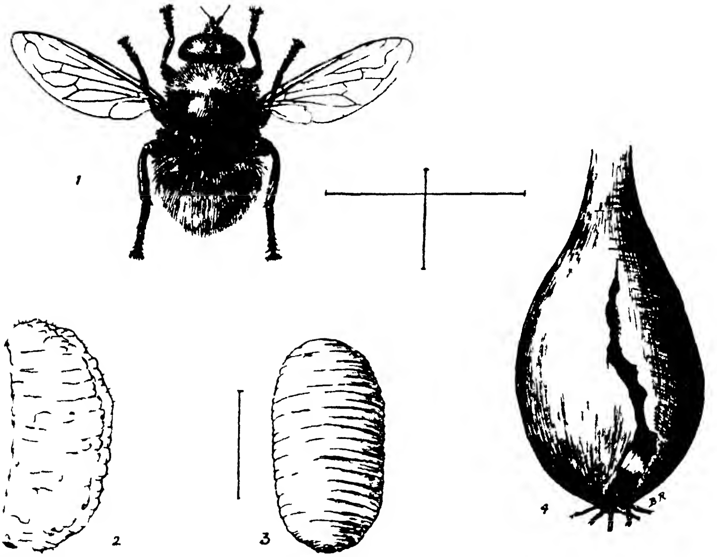
Description of Insect.—The *fly* measures half an inch and over. The flies are hairy; the hairs vary so greatly in colour that numbers of varieties of the species have been described. Generally the adult may be said to suggest a small humble bee; the narrower body, the presence of only two wings, and the very active flight will serve to distinguish Merodon from a bee.

The ground colour of Merodon is black, but, on the middle region of the body especially, this is hidden by the marked pubescence, which varies from grey to pale yellow, to tawny and darker. Verrall, in his British Syrphidæ—the family to which Merodon belongs—describes in detail three well-marked varieties, but there are others. Apart from colour variations and pubescence, Verrall emphasises the moderately hairy eyes; the black legs; the tibiæ of the hind leg "humped

inside just about the middle," and with a conspicuous spine at the tip; and the tooth on the thickened femora. The wings are somewhat short and rounded.

The *egg* is minute, but visible to the naked eye, oval in shape, and white in colour.

The *larva* or *grub* is legless, and measures from half an inch to three-quarters of an inch in length when extended. The body is stout and rounded, and the joints are well marked; it is arched on the upper side, and flattened on the under surface. In front are the dark mouth hooks and two



NARCISSUS FLY (*Merodon equestris*, Fab.): 1, Fly; 2, Larva; 3, Puparium; all × 2, with lines showing natural size. 4, Tunnelled bulb × 1

short breathing tubes, which are brown in colour. At the rounded hind end is a dark projection, on which the hind breathing pores are situated, and on each side of this is a short spiny horn. The colour of the larva is greyish-yellow.

The *pupa-case* is dark; it is marked externally by a transverse ringing; at the front end respiratory structures show as two minute, dark horns, and there is a dark projection at the hind end.

Life History and Habits.—The flies are fond of sunshine, and fly actively, so that they are not netted easily on the wing. They are found flying in May, June, and July. Bos, in his Monograph on *Merodon equestris*, mentions as a result of

dissection and examination of the ovaries that 100 eggs can be laid. The eggs are laid at the base of the leaves or close to the plants. The larvæ on hatching pass into the bulbs between the scales, gnawing the bulb scales, and growing slowly. The issue and flight period of the flies extends over May and June and into July, and therefore an examination of bulbs can yield at the same moment larvæ at different stages of growth. Theobald obtained pupæ in England in late autumn; Bos describes the pupæ as commoner in Holland in spring. I have found larvæ in the north in the month of February. Wilks got three-quarters-grown larvæ in March. Typically there is only one grub to a bulb. A grub may leave one bulb and pass into another. The full-fed grub may pupate in the spoiled bulb, but more generally leaves the bulb —by making, it may be, a hole in the base of the bulb—and moves towards the surface for pupation.

Treatment.—(1) Removal from the beds of bulbs and plants that are failing; such plants should be destroyed.

(2) Careful examination of the bulbs at the time of lifting, and also, especially in case of importation, before planting, with the destruction of bulbs that are decayed and infested. Infested bulbs have not, on pressure with the fingers, the firmness of sound bulbs. In the case of early planting the risk is greater of passing over bulbs that contain the grub. In daffodil-growing grounds, where some years ago Merodon was proving a great pest, the persistent examination for, and destruction of, sickly bulbs has resulted in its being the rarest occurrence now to find a Merodon.

(3) Sieving the surface layers—where this is practicable—for pupæ. In Holland the surface layers are searched "about the time that the plants are coming into flower."

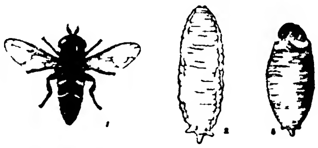
(4) Steeping the bulbs in water. Bos recommended this method in order to drive out and drown the larvæ. The bulbs are left in water for from two to eight days. The records of a number of experiments show that while good results may follow, there are failures indicating that the treatment may not succeed. A recent case reported to the Board may be quoted. A grower had bought £100 worth of bulbs, and found that a large proportion was attacked with Merodon. When the bulbs were lifted some were left untreated, but the greater

number were put into large tanks filled with water, and left for two days. By this time there was a layer of dead Merodon larvæ at the bottom of the tanks, these larvæ having left the bulbs. The bulbs were dried, and ultimately planted, as were also the untreated bulbs. In the following season there were many "misses" among the untreated bulbs, but practically none among the treated.

(5) Netting the flies. The flies will not be caught on the wing, but they should be followed up, and when they have settled caught in a hand-net. Reports to the Board attest the value of this measure.

Eumerus strigatus, Fln.

Theobald, in his Second British Museum Report, 1904, recorded the finding in bulbs of Narcissus of another Syrphid larva, which on being bred out proved to be *Eumerus strigatus*. In 1847 this fly did great damage to onions on the Continent; the larvæ have also been found in the shallot. Further, Theobald has found them in bulbs of hyacinth. The Eumerus larvæ may be found at work along with a Merodon



BULB MOON-FLY (*Eumerus strigatus*, Fln.)
Fly, larva, and puparium, all magnified

larva, or they may be found by themselves. On the Continent Eumerus is known as the Bulb Moon-fly, from the light specks on the abdomen due to grey hairing on a dark background. This is indicated too by its other scientific name, *E. lunulatus*, Mg.

The larva measures half an inch and over when full grown. It is greyish-yellow in colour, and has a distinctly wrinkled appearance. The mouth hooks are brown, and the respiratory processes at the front end are brownish-red. The rounded hind end is brown at the tip, and has a projection on each side, with a process which ends in the breathing pores between the projections.

A number of Eumerus larvæ can be present in a single bulb. Infested bulbs become discoloured, and rot away.

Other Flies.

Other flies of a different family may lay their eggs in decaying bulbs. In bulbs of Glory of Leiden and Duchess of Westminster I found numbers of Sciara larvæ, the adults emerging in the last half of September. From decaying bulbs I have at different times bred species of several genera of *Mycetophilidae.*

THE TENTH INTERNATIONAL CONGRESS OF AGRICULTURE.

THE International Congress of Agriculture, which was held this year at Ghent from the 8th to the 13th June, was the tenth of a series of periodical Congresses which have been convened and organised by a permanent committee, the International Commission of Agriculture, appointed at the Congress held in connection with the Paris Exhibition of 1889. The Congresses held under the auspices of this permanent Commission since 1900 met at Paris in 1900, at Rome in 1903, at Vienna in 1907, and at Madrid in 1911.

These Congresses are of great value to the agricultural industry, not only on account of the extensive series of reports they publish, but as a means of bringing together the agriculturists and specialists of many countries, whereby ideas may be exchanged and a better understanding obtained of their respective objects and methods.

In the case of the recent Congress, a special British Committee was formed, and as a result the list of British members adhering to the Congress was much greater than on any former occasion. In addition, the Committee were able to secure the contribution of some twenty-one special papers dealing with one or other of the subjects included in the syllabus of the Congress.

Great Britain was officially represented at the Congress by Sir Sydney Olivier, K.C.M.G., Sir James Wilson, K.C.S.I., Mr. T. H. Middleton, C.B., and Mr. A. B. Bruce, of the Board of Agriculture and Fisheries, Mr. R. B. Greig, of the Scottish Board of Agriculture, and Mr. M. G. Fletcher, of the Department of Agriculture and Technical Instruction

for Ireland. Sir George Fordham was Chairman of the British Committee.

The opening meeting of the Congress took place on Sunday, the 8th June, at the Palais des Académies, Brussels, and M. Méline, President of the International Commission of Agriculture and formerly Prime Minister of France, presided. In the course of his opening speech, M. Méline said:—

"I wish, as my contribution to your labours, to bring before you to-day one single conclusion which appears to me of such a nature as to give us confidence in the future of the agricultural industry. This conclusion is reached by a close analysis of the general movement of production in the world as regards those two great necessities of life, corn and meat.

"This work of analysis has for a long time been rendered impossible by the insufficiency and the lack of uniformity in the statistical records. Each country having different weights and measures, comparisons were difficult, and the general progress of production was obscure.

"The International Agricultural Institute at Rome recently threw some light on this question by publishing complete information on the production of wheat in various countries for the last ten years, and for this we are much indebted to the Institute. The French Ministry of Agriculture has done more, for, with great labour, it has issued a comparative statement of the production of wheat in various countries for the last thirty years, converting all the foreign measures into the metric system.

"I will not touch upon those details of this statement which interest France except in respect of one important point. The statement in question shows that the production of wheat in France during the past thirty years has increased by 16 million hectolitres, although the area cultivated has remained almost stationary, the increase being the result of an improved yield *per hectare*, or, in other words, the result of perseverance on the part of French agriculturists, and an advance in their cultural methods.

"I come now to the world-production of wheat. I say world-production, because the statement in question contains the analysis of the production not only of wheat in Europe and America, but in Asia (including India and Japan), Africa, and Oceania It shows that the total area under wheat in all these countries, which was 70 million hectares from 1881 to 1890, rose to 95 millions in 1901 to 1910, during which period the production also rose from 624 million to 880 million quintals. Thus the area cultivated has increased by practically 36 per cent. and the yield by 41 per cent , the improvement in the yield being general. In this respect America shows an increase of 55 per cent., Europe 32 per cent , and Asia only 6 per cent.

"But in order to be satisfied as to the future of the world's supply of bread, it is not sufficient to show that the yield of wheat continues to increase. It is necessary to consider two other important factors. One of these, the increase in the population, that is to say, in the number of consumers, may be estimated fairly accurately. The other factor

is the growing requirements of consumption, which all over the world tend to concentrate more and more on bread, and especially bread of good quality. The extent of this factor is unknown, but it is increasingly active. When, however, one examines the first-mentioned factor, one finds that in Europe the population increases much more rapidly than the production; if, for instance, the latter is compared with the number of inhabitants at different periods, one finds that the average production of wheat in Europe has fallen in thirty years from 126 kilogr. to 117 kilogr. per head.

"Europe is, therefore, to-day deficient in its production of wheat despite the considerable yields of the rich granary of Russia, and it is to the great wheat-producing countries of America that we are more and more obliged to turn for the supplies necessary for our consumption; but on this side also the horizon is darkening, and it is already possible to foresee that in the near future the yield of the New World will no longer increase with the increased consumption. The United States, which was half a century ago the great wheat reservoir of the world, a reservoir which was believed to be inexhaustible, sees each year its reserves absorbed by the mounting tide of new consumers.

"Up to 1900 the cultivation of wheat, it is true, considerably increased, for the area sown had grown from 14 to 20 millions of hectares; but since that year this upward movement has been arrested and the yield has ceased to increase, whilst the number of mouths to be fed has grown from 63 to 92 millions. The result of this is naturally a decrease in the surplus of the United States wheat available for exportation; these exports were on an average up to 1903 some 72 million hectolitres, whereas to-day they stand at scarcely 20 or 25 millions. One can therefore foresee that, as the result of a really bad harvest, the United States would, in their turn, become importers of wheat

"It is true that side by side with the United States, there is growing up a powerful people with immense agricultural territories at their disposal, which are in full development and which at first sight would seem able to take the place of the States in the production of wheat. I refer to Canada, the three great western provinces of which alone produce more than 40 million hectolitres of wheat, and which exported in 1910 18 million hectolitres of grain and 5 million hectolitres of flour. But here, again, one already begins to see the probability of a falling-off in the future; the rapid growth of the population in Canada threatens, as in the United States, to absorb sooner or later all the surplus of the harvest they are able to produce. During the last ten years the population of Canada has grown by nearly two millions, and immigration is constantly increasing. In 1910 the number of persons that immigrated to Canada amounted to 303,000, of whom 124,000 came from the United States.

"You see, therefore, the great wheat markets outside Europe, which for a long time have been considered to provide an inexhaustible reserve, tending more and more to harden, and to be reduced to supplying the needs of their increasing populations, who are attracted by the richness of the soil and the facilities for making a profit out of their labours.

"No doubt there remain other sources in process of development,

such as Argentina and Australia, from which countries exports are already large, but even these will not suffice to make up for the decrease from the United States.

"From this brief and suggestive analysis of the present world-production of wheat I consider that we are justified in coming to the conclusion that we have now arrived at a time when the desertion of the rural areas tends perceptibly to reduce, especially during the last ten years, the production of the supply necessary for the sustenance of mankind as regards the first and most important article of general consumption, wheat.

"If we now pass from wheat to that other article of food, meat, of which the consumption per head of the population also increases in proportion to the improvement in the condition of life, we find an even less happy state of affairs; because one cannot increase a herd at will as one can increase the acreage grown with corn. Here again the great exporting countries outside Europe appear to be reducing the quantity of live stock just at the time when the demands of their own increasing populations require a larger quantity of meat supplies.

"In Canada the quantity of cattle, sheep, and even pigs continues to diminish, so that the number of horned stock exported has fallen by 80,000 and of sheep by more than 400,000. I might add, in passing, that while Canada used to export some 12 millions of poultry, it now exports none; it no longer exports eggs, but it is obliged to import them, although formerly it exported 11 millions of dozens.

"In the United States we find the same condition of things; for a long time a marked reduction has been apparent in the production of live stock. The results of the last census show that from 1900 to 1910 all branches of live stock breeding have diminished, whilst the population has been increasing during the whole period The falling off has been 4 per cent in the case of cattle, 9 per cent. in the case of sheep, and 4 per cent. in respect of pigs. It is clear, therefore, that unless the breeding of live stock in that country again develops, the United States will soon have to make great sacrifices to feed its immense population.

"I must ask you to forgive me for quoting so many dry and indigestible figures, but I desire, before this great meeting of representatives of the world's agriculture, to put my finger on an economic fact of the highest importance, because it is one which should open the eyes of everyone to the necessity for taking precautionary measures

"Happy are those countries which have sufficient to supply the needs of their population. They are able to remain tranquil as to their future, so long as they maintain their agriculture As for the other countries, they will be well advised not to wait until they are affected by a general shortage of food. They will, of course, not die of hunger, but they will have to pay exorbitant prices for their bread and their meat, and will be obliged to search the world for their supplies.

"Thus, after a long and tedious digression for which I again apologise, I return naturally to my original starting point, the question of the depopulation of the countryside, which tends to become a general characteristic All countries are interested in meeting this difficulty and in bringing back capital and labour to the soil, if they do not wish

to suffer cruelly from their culpable indifference to the situation. Those who, in their improvidence, have allowed the evil to grow will be bound to pay a tribute of increasing weight to those privileged countries which will become the masters of the economic position as regards exportation.

"Civilised man can deny himself many things, but he is unable to get on without food, and the more he is civilised, the more exacting he is as to his nourishment, and he will therefore make every sort of sacrifice in order to continue the manner of existence to which he has become accustomed. In this way, through the force of circumstances, if other means fail, the return to the land will be brought about by natural causes The desire for gain will bring back the workers to the soil, just as it has led them to the factories. Agricultural workers must be paid such wages as are necessary to retain their services, and farmers, like other employers, will add this increase in the cost of production to the price charged for the produce. In this way the proper balance, which has been broken for so long to the detriment of agriculture, will be re-established to its advantage

"But, you may say, if these things happen living will become more and more dear, and already to-day times are hard enough Complaints are general and everyone asks himself to-day how things will be to-morrow. I do not dream of denying it, and I regret as much as anyone the hardness of modern existence. It is in order to make that existence easier and to put a limit to the present state of things, that I utter this warning and never cease to draw attention to the unfortunate consequences of the desertion of the countryside.

"I draw attention to them in the hope that the evil itself may be productive of the remedy I know indeed of only one means, but it is a decisive means, of checking the rise in price of food, and that is by continuously increasing production, the comparative scarceness of foodstuffs in the world being the main cause of their high prices

"One must bring back to the land some part of the unthinking crowds which pour into the great towns, crowds which the State seems to wish to draw into and retain in these centres In order to counterbalance the attractions of town life, we must give agricultural labourers houses as comfortable as those built for town workers. We must endeavour to turn them into small owners in order to bind them to the soil Life in the village must be made more agreeable, and middle-class landowners must set a good example by not disdaining to cultivate their own land The education given to women should create in them a love and pride in the agricultural profession. The agriculturist should be regarded as a public benefactor, and education, art, and literature should be the advocates of a rural life. So will the balance between agriculture and other industries, between the country and the town, be re-established and we shall once more enjoy the benefits of cheap living."

After the opening meeting, the work of the Congress was continued at the Palais des Fêtes of the International Exhibition at Ghent. The Congress was divided into five sections, each of which dealt with a different group of subjects, classified

as follows:—(1) Rural Economy, including rural depopulation, agricultural co-operation and credit; (2) Science of Agriculture, reports on special crops, and Agricultural Education; (3) Animal Industry; (4) Rural Engineering; and (5) Forestry.

On the afternoon of the 11th June, the Congress was brought to a close by a general meeting under the presidency of M. Méline, at which the reports and resolutions of each of the five sections were formally presented, and speeches dealing with the success of the Congress were delivered by several of the foreign representatives.

On the 12th, 13th, and 14th, members of the Congress made excursions to several of the most important agricultural districts and institutions in Belgium.

POULTRY KEEPING ON A SMALL HOLDING.

J. H. SCOTT.

THE holding includes about half an acre of grass land, which is divided into five equal parts, and is sheltered on the west by a wood, and on the south by a high hedge. The greater part is well shaded, making a favourable site for rearing chickens during the summer months; the soil is light, with chalky subsoil, not well drained, and very wet during the winter.

The object of the small holder was to find what results could be obtained by devoting a short time—say from one and a half to two and a half hours—per day to keeping poultry for utility purposes, mainly egg production.

The houses are of the open-fronted type, with shutters to draw up at night, and have scratching sheds adjoining, capable of accommodating up to twenty birds per house; floors are provided for both houses and shelters.

The stock at the outset numbered twenty-eight birds, composed of two breeding pens, Buff Orpington and Minorca, containing six pullets and one cockerel each, and fourteen cross-bred pullets which had been bred the previous year.

All hatching was done by pullets, and extended from the 16th April until the 26th June. During the season 104

chickens were reared to maturity, and of these only the cockerels were sold.

Feeding.—Feeding took place at regular times, and no waste occurred through food lying about on the ground. Chickens up to four months old were fed four times a day, and each alternate meal was of soft food. The adult stock received two meals daily during the summer months, and during the winter a midday feed was added. In severe weather the morning meal was given hot.

The food used was good sound grain, considerable quantities being purchased at a time. The following diet indicates the nature and amount of the foods purchased:—Wheat, 3,696 lb.; sharps, 1,526 lb.; maize, 406 lb.; meal, 224 lb.; chick seed, 182 lb.; bran, 126 lb.; meat meal, 70 lb.; barley, 56 lb.; oats, 42 lb.; biscuit meal, 42 lb.; flint grit, 224 lb.; shell grit, 224 lb.

A plentiful supply of clean water was provided. As the birds had access to grass runs, no other green food was found necessary.

Sales.—All eggs were sold on the holding, thus saving any cost for carriage, but birds were marketed in the feather at the nearest town. Some twenty odd sittings of eggs were sold locally without advertising.

Sixty-three birds were sold during the year, leaving a balance of 69 birds at the end, to which must be added 16 chickens hatched in February and March.

The account on p. 607 shows a balance of £14 1*s.* 9*d.* towards the items of rent, interest, and depreciation, and to repay the small holder for his work.

Appliances and Cost.—The cost of appliances was as follows:—

5 Houses ..	9	0	3
9 Coops	1	11	6
* Flooring	1	1	6
250 Stakes ...	1	16	5
9 Rolls Netting ..	4	11	0
6 Food Tins	0	7	6
12 Earthenware Pans ...	0	2	0
Sundries	1	6	1
	£19	16	3

Capital.—The total amount of capital required to establish

* Appliance makers charge somewhat heavily for floors, and it was found cheaper to buy three-quarter inch match boards for the purpose.

RECORD OF THE NUMBER OF BIRDS IN STOCK AND EGGS LAID FOR EACH MONTH FROM APRIL, 1912, TO MARCH, 1913.

1912	Cockerels	Pullets 1911 hatched	Chickens	Sales.	No of Eggs laid.
April ...	2	26	29	—	522
May	2	26	29 66	—	386
June	2	26	95 9	—	373
July ..	2	26	104 2	2	360
August ...	2	26 3	102 24	27	324
September .	2	23	78 16	16	188
October	2	23	62 7	7	49
November	2	23	55 2	2	130
December ...	2	23 1912 hatched 53	53* —	—	431
1913 January	2	76 9	—	9	700
February . March	2	67	9 7	—	791 1,247
	2	67	16	Average	458 4

a poultry plant of this size is from £25 to £30. The whole of the appliances need not be purchased at the outset, but may be obtained gradually as the stock increases, and all will be

* These were all pullets commencing to lay, so are transferred to previous column.

required by the end of October; produce will be sold from the commencement of operations, and by the time the whole expenditure is needed, sufficient should have been realised to meet it.

TRADING ACCOUNT.

	£ s d		£ s d	£ s d
Stock 1st April, /12	3 7 6	*Sales*		
Food	22 14 2	Eggs	26 5 9	
Extra Labour	0 12 0	Birds	6 18 0	
Carriage .	1 9 10	Sittings	2 7 5	35 11 2
Sundries ...	1 15 9	Stock : 31 March, /13		8 9 10
Balance ...	14 1 9			
	44 1 0			44 1 0

Throughout the year the stock was entirely free from disease.

The Agricultural Section of the British Association.

AT the recent meeting of the British Association in Birmingham, Prof. T. B. Wood, M.A., of Cambridge University, was the President of the Agricultural Section, and delivered an interesting address. He took as his subject the history of the development of agricultural science, as exemplified by the progress made during the last twenty-five years. He pointed out that the definite provision of funds for technical instruction in the year 1890 was the starting point of a movement which, leading to the provision of many facilities for agricultural education and research, culminated in the establishment of the Development Fund and the provision of large sums of money definitely for the advancement of rural industries.

Prof. Wood went on to consider in detail the advances that have been made in various departments of agricultural science. In regard to the additions to knowledge that have resulted from the numerous field experiments that have been made in recent years, he characterised those relating to the effects of phosphates on grass land as among the most valu-

able, particularly from the point of view of the definiteness of the recommendations that can be based upon them, and he indicated that this was largely due to the fact that the returns from the manuring of grass land with phosphates are so marked that the advantage of the treatment can be strikingly demonstrated by experiments limited to single plots. In some cases the use of phosphates leads to a doubling of the return, and a difference of this extent is not liable to be masked by variations of soil or season. When, however, the treatment under investigation leads to smaller differences, comparable with the effects of such variations, the single plot system is no longer capable of being used so as to give trustworthy results in a single season. This is strikingly apparent in regard to the competitive testing for yield of different varieties of field crops, in regard to which the single plot system has been productive of most conflicting results. For this purpose, it was recommended that the number of plots used should be increased, and that they should be small and placed side by side in chess-board fashion, so as to reduce the error from possible variations in the nature of the soil.

In regard to field experiments generally, Prof. Wood was of opinion that agricultural science has now reached a stage in which the obvious facts have been sufficiently well demonstrated, and that further knowledge can be acquired only by the expenditure of continually increasing effort and the use of greater care and accuracy than has been possible hitherto. In this connection the lecturer emphasised the fact that the modern farmer is only too glad to make use of new discoveries, but care must be taken that new developments are carefully and accurately tested before they are introduced to his notice. Public authorities have a duty in this matter; they should take care that the funds which they control are not used to subsidise the publication of inaccurate and inconclusive information, and they might well consider whether undue pressure for results does not tend to foster this evil.

The remainder of the address was concerned with some of the more prominent results obtained in relation to specific problems of agricultural science.

Attention was directed to the remarkable researches at Rothamsted on the science of the soil, more particularly to those connected with the enhanced fertility which follows soil sterilisation. The earlier views on fertility were based on the assumption that infertility is caused by the *absence* of fertilising ingredients; there is now reason to believe that an important cause of infertility is the *presence* of factors which inhibit the action of the fertilising ingredients. It has been established that this inhibiting agent can be removed either by heating or by the addition of antiseptics, though whether this means of increasing fertility is feasible on a field scale has still to be determined. That it is applicable to glass-houses has already been demonstrated, and sterilisation of soil is becoming a routine practice among the market gardeners of the Lea Valley.

The lecturer went on to deal with the wheat breeding investigations conducted at Cambridge by Prof. Biffen. These have been recently noticed in this *Journal* in connection with the report of the Home-grown Wheat Committee.

In conclusion, recent work on animal nutrition was dealt with. It was pointed out that in view of recent discoveries, the nitrogenous contents of a ration can no longer be classed indifferently as proteins, or albuminoids, regardless of the specific nature of the source from which they are derived. The proteins of maize, for example, have a very different nutritive value from the proteins of linseed. The difference seems to depend, in some degree, on the difference in the specific composition of proteins from various sources, for on digestion in the intestine they split up into bodies of varying composition and properties.

Another new conception is the importance of the rôle of minute traces of certain substances in a diet. It has been shown, for example, that a "fresh" food, such as milk, contains a minute quantity of some unidentified substance, which, when added to a purely artificial or chemical diet, makes it capable of supporting life, and the presence of which is essential to the function of growth.

Again, it was pointed out that, from the purely quantitative point of view, there is still much uncertainty as to the value of various foods. There have, for example, been no trust-

worthy experiments carried out in this country to determine the nutritive value of "roots" when fed in the quantities usually given in Great Britain.

The lecturer closed his address by reiterating the need for greater accuracy than has been customary in the carrying out of field experiments and feeding tests. With these views complete agreement may be expressed, as also with a further recommendation that he made, namely, that these experiments should be confined to a single, or at most two, issues, and that a sufficient number of plots (or animals, in the case of feeding trials) should be used to allow of some degree of certainty being attached to the results.

A number of interesting papers were read at the meeting, and a notice in regard to them will appear in a subsequent issue of the *Journal.*

Sugar Beet in the United States

A NUMBER of interesting facts in connection with the growth of sugar beet have been collected in a pamphlet recently issued under the authority of the Senate of the United States.*

The object of the author of the pamphlet—Mr. Truman G. Palmer—is to convince the American farmer that not only is sugar beet a profitable crop in itself, but that it also indirectly benefits the succeeding crops of the rotation. In this country, there is no need to demonstrate the value of a "hoed crop" to the succeeding cereal crops. It is otherwise in America, where the practice of growing continuous crops of one variety appears to prevail. How different the conditions of agriculture are in America can also be realised from the statement that "many American farmers still fail to recognise the value of barnyard manure, and consider it a nuisance, inasmuch as the accumulations must be removed."

As an example of the benefits that follow the introduction of a root crop in the rotation, the author instances the case of Germany, where, since the introduction of the culture of sugar beet thirty years ago, the average yield of cereal crops per acre has increased by 80 per cent., whereas, in the same period, the

* Sugar at a Glance—Charts and Data 62nd Congress · Document No. 890

yield per acre in America has increased by only 7 per cent.

The argument in favour of sugar beet as against other root crops is stated as follows:—"Sugar beet . . . is a cash crop, while other (root) crops can only be fed to stock, and farmers haul back to their farms by-products which contain all the elements extracted from the soil, and the feeding value of which is but slightly diminished by the extraction of sugar."

Nevertheless, the sugar beet industry in the United States is not inconsiderable, and appears to be extending. In 1911, 606,000 tons of domestic beet sugar were marketed, whereas in 1900 only 86,000 tons were produced.

In 1911 the area under beets was approximately half a million acres, and the average produce per acre was about ten tons—a low figure compared with the yield obtained experimentally in the United Kingdom. The number of beet sugar factories in 1909 was 65, with an aggregate capital of £14,000,000. The total consumption of sugar in the United States is about three and a half million tons annually, of which about 20 per cent. was supplied—mainly to the Western States—by home-grown beet. The imports of foreign cane and beet sugar represent about one-half of the total, and as the average rate of import duty levied on these is less than one penny per pound, the home-grown product does not benefit very much from protection.

In the publication under notice, statistics are given based on returns from 115 farmers, showing the effect on the average yield of other crops of the introduction of the growth of sugar beet. Thus it is stated that the cultivation of beet has resulted in an average increase in the yield of wheat of 50 per cent., in barley of 52 per cent., and in maize of 28 per cent.

These facts, however, have little bearing on the special problem of interest here, that is, whether sugar beet would be a more profitable "hoed crop" than mangolds, turnips, or potatoes. Continental countries and America have only recently begun to follow the lead given by the United Kingdom more than a century ago, and are realising the benefits that we have enjoyed since the introduction of turnip growing by Townshend.

Cross-pollination of Fruit Trees.

It has long been the custom among fruit-growers when laying out an orchard to plant trees of more than one variety, whether the orchard consists of apples, pears, or cherries. The object has generally been to secure a constant supply of fruit over as long a season as possible, so that if for any reason one kind fails, the loss may be recouped by the other varieties. Occasionally, however, the attractiveness or value of one variety has led to the planting of an extensive acreage of that kind exclusively, and the results have disappointed the grower, who has been unable to understand why a certain variety of fruit tree which bears excellently in an adjoining plantation should yield so small a crop with him. An instance which has recently been brought to the notice of the Board may be given as an illustration. In the neighbourhood of Sevenoaks, Kent, a cherry orchard extending over about 18 acres was planted, probably thirty to thirty-five years ago, with trees of the variety known as Amber Heart, or Amber Bigarreau. No other cherry trees are grown in the immediate vicinity, though there is a mixed orchard in which this variety appears in conjunction with other varieties at some distance. The orchard, however, in which the Amber Hearts were planted to the exclusion of all other varieties has never borne a proper crop, though the trees in the mixed orchard have done well. The trees in the first plantation are in good health and have been well manured and cultivated. The advice of the Board was sought, and on inspection it was discovered that apparently eight to ten years ago at regular intervals a tree had been cut out and in its place a cherry of the variety known as Frogmore Bigarreau had been planted. The presence of these trees supplied the clue, for in their immediate surroundings the Amber Hearts bore a small crop, the fruit setting in many instances only on the side facing the Frogmores. It is clearly demonstrated that Amber Heart is a self-sterile variety, and quite unsuitable to plant except in a mixed orchard, although the fruit when it does set is very attractive. Unfortunately the Frogmore Bigarreau blossoms slightly later than the Amber Heart, and a much better result would have been obtained had some other variety been planted instead.

There is reason to think that many similar cases have occurred in other parts of the country. The failure of Cox's Orange Pippin in many places can be ascribed to this cause, and it is believed that some orchards which contain only Rivers' Early Plum suffer in the same way. The remedy in most cases is obvious. Instead of re-grafting the trees with a commoner but self-fertile variety, a suitable mixture of varieties should be introduced after a large number of the self-sterile trees are cut out. But as this is not always practicable in an old-established orchard, the work of pollination should be stimulated by the introduction of a few colonies of bees. If this is done the number of new trees of a different variety that must be planted in the orchard can probably be reduced. Care should, of course, be taken to introduce trees of a variety that blossoms about the same time as the old trees.

In this connection it may be mentioned that in an experimental orchard recently planted, a row of crabs known as John Downie, which is a profuse bloomer and free bearer, was introduced with the object of supplying the necessary pollen for cross-fertilisation. As further inquiries have revealed the presence of a large number of orchards in England which are failing to give any profitable return owing to the lack of proper pollination, arrangements are being made by the Board through their Horticultural Branch for a more detailed investigation of the subject, and the Board would be glad to receive communications from any fruit-grower whose fruit trees have given a deficient return, and who is willing to assist them in their inquiry.

Arsenical Poisoning from Sprayed Apples.

A report to the Foreign Office by H.M. Consul at Christiania draws attention to an article in the Norwegian *Morgenbladet* of the 26th August, by Dr. Sopp, well known in Norway as a food bacteriologist, warning the public against the possibility of arsenical poisoning from eating imported "American" (*i.e.*, from Canada and the United States) apples.

Dr. Sopp states that owing to indisposition after eating apples he was led to examine a number of "American" apples,

and found on two of them, in the hollow near the stalk, a visible layer of green powder. A microscopic examination showed that the green powder contained both copper and arsenic—more than sufficient to explain the symptoms of poisoning if the apple was carelessly peeled. It is also stated that there were traces of Paris green all over the poisonous apples where uneven, and that there was reason to fear that some of the arsenic had penetrated into the flesh of the apple.

The presence of the poison is attributed to the practice of American fruit growers of spraying fruit trees with Bordeaux mixture and Paris green, not only before the trees are in bloom, but also in some cases after the fruit has begun to set, the amount of rain between this time and harvesting not being sufficient to wash away the spraying materials from the hollows near the stalk and eye of the apple.

It is necessary, therefore, to warn growers in this country against careless spraying. It must be pointed out, however, that, with ordinary caution on the part of horticulturists, the danger of arsenical poisoning from apples is negligible.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

MANURES.

Determination of Citric Acid Soluble Phosphates (*Die landw. Versuchs-Stationen*, Band lxxxii., Heft v u. vi.—*H. Neubauer*).—The citrate methods of determining phosphates in manures have, it is stated, been very popular for more than twenty years both on account of the quickness and ease with which the tests are carried out and the usually close agreement in the results. This agreement is, however, only found with quite similar methods of work; it is not only dependent on the quantity and composition of the reagents used, but disappears with changes in the substances accompanying the phosphates in the solution. Different results are, for instance, obtained according to whether the phosphate is dissolved in sulphuric or hydrochloric acids.

Especially strenuous attempts have been made to apply the citrate methods for determining the citric acid soluble phosphates in basic

* A Summary of all reports on agricultural experiments and investigations recently received is given each month The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons

slag. The chief difficulty lies in eliminating the silicates simply and effectively, so that a phosphate precipitate free from silicates may be obtained. Side by side with the citrate methods a test invented by Lorenz (the molybdate test) has been employed, and is found to give lower figures than the different citrate methods. The difference between one of the citrate tests and the Lorenz test has recently been shown to be only 0·09 per cent. of the quantity of basic slag, but the difference is somewhat larger with the other citrate tests.

These investigations were therefore undertaken at the Bonn Experiment Station to discover the relative accuracy of the two tests. The phosphate content as determined by the Lorenz method was found to agree exactly with the true phosphate content; and the citric acid content of basic slag solutions was found to have no disturbing influence on the Lorenz test. It was shown that the citrate test always gave too high a figure for the content of phosphates, even when, by using the citrate of iron solution, there was no appreciable precipitation of silicates, and in spite of the current belief that the error is balanced by a quantity of the phosphate remaining in the solution unprecipitated, no appreciable quantities of unprecipitated phosphates were found. The explanation of the higher figures given by the citrate test was shown to be principally that calcium oxide was precipitated with the phosphates as tricalcium phosphate.

This error, due to the presence of lime, when determining the soluble phosphates, is greater in basic slag than in superphosphate, as the former manure has the higher content of lime.

LIVE STOCK AND FEEDING STUFFS.

The Feeding Value of the Horse-Chestnut (*Jour. of the Society of Chemical Industry, No. 4, Vol. xxxii. S. J. M. Auld, D.Sc.*)—Many inquiries as to the possibility of using horse-chestnuts for feeding purposes were received at Wye College in 1911, and since very little relative information existed it was decided to investigate the value and suitability of horse-chestnuts as a constituent of regular rations for various animals. Analysis showed the nut to contain: water, 3·04 per cent.; ash, 2·66 per cent.; crude protein, 10·99 per cent.; oil (ether extract), 5·34 per cent.; carbohydrates, 73·97 per cent. The most satisfactory method of preparation was found to be as follows. Partly-crushed chestnuts were allowed to soak in cold water over-night, then boiled for half an hour or so and the water rejected. The residue was dried, partially husked, and reduced to a meal. Although the meal was slightly bitter, it had a pleasant smell and appearance. It contained: water, 8·2 per cent.; ash, 2·5 per cent.; crude protein, 9·3 per cent.; oil (ether extract), 6·3 per cent.; crude fibre, 9·5 per cent.; carbohydrates, 64·2 per cent. In the trial conducted the meal was fed to a calf, a sheep, and two pigs. It is concluded that horse-chestnuts are not poisonous to any of the farm animals experimented with, within the limits of what they can be induced to eat, and they form a highly nutritious food. The calf, which received up to 5 lb. of the meal per day, made good increase in live weight, and the sheep suffered no ill-effects. The pigs, however, refused to eat the food containing the meal. Chestnut meal is a fairly concentrated food having an

albuminoid ratio of 1 : 8 6 and starch equivalent 74. Calculated from the starch equivalent, 1 lb. of horse-chestnut meal would be equivalent to 1 lb. 1 oz. of feeding barley, 1 lb. 4 oz. of oats, 1 lb. 8 oz. of bran, and 2 lb. 5 oz. of good meadow hay.

Value of Banana Meal for Pigs (*Arbeiten aus dem landw. Institut der Univ. Halle. Sonderabdruck*, 1913).—These experiments were undertaken as it was thought that dried bananas could be placed on the market at a price which would bring them within reach of agriculturists for stock feeding. At the Halle station bananas of various origin were analysed, their digestibility for pigs ascertained, fattening experiments carried out, and their effect on the meat of pigs investigated. The experiments are summarised as follows :—

Banana meal is very rich in carbohydrates—mainly starch; the content of fibre and fat is small The content of protein is, however, not very large, so that, in order to utilise the carbohydrates to the fullest extent, the meal must be fed with foods rich in protein.

The content of ash is small—the two most important constituents being potash and phosphoric acid

The meal has a high digestibility Meal from peeled bananas was found more digestible than meal from unpeeled bananas, but there was not much difference. The fibre was found to have a high digestibility for pigs, in spite of the fact that the organs of these animals are not well fitted for digesting fibre.

The live-weight increase in fattening experiments confirmed the high digestibility of the meal from peeled bananas.

The carcasses of pigs fed on banana meal were found to contain less cellular tissue than those of pigs fed on dried potato flakes.

Calf-Rearing on the Emulsion System (*Bull. of Agric. Intell. and Plant Diseases, Feb.*, 1913; *Dr. Paul Schuppli*).—In these experiments, which have been carried out for eight years, coconut-fat was used as a substitute for butter-fat. This substance contains 99 per cent. of pure fat and is the cheapest vegetable fat obtainable. The fat and skim-milk were mixed in the proportion of 35 grams of fat to 1 litre of milk (5½ oz to 1 gal.), heated to 60° C. and passed through an emulsion drum. A milk containing 3½ per cent. of fat was thus obtained at a cost of 4½*d.* per gallon. For satisfactory results the milk must be made fresh each time.

It was found that calves could be reared much more economically on emulsion milk than on a mixture of whole and skim-milk, and that there was no difference in the final weight of calves reared according to these two systems.

The Poisonous Properties of the Seeds of Jatropha (*Die Landw. Versuchs-Stationen*, Band lxxxii., Heft v. u. vi.—*J. Felke*).—Attention was drawn to this subject by the occurrence of some cases of poisoning in Germany by the seeds of *Jatropha curcas*.

The plant belongs to the order *Euphorbiaceæ*, and grows throughout the tropics. It is used for medicinal purposes; the oil from the seeds seems to be used for burning, soap-making, and for adulterating croton oil and other oils. The nuts and oil form the chief exports of the Cape Verde Islands, while there are also exports of the oil from Sierra Leone.

The article under notice gives the composition of the seeds, refers

to experiments both with the oil and seeds, and reviews cases of poisoning. The author summarises his observations as follows:—

Curcas seeds contain: (1) A poisonous agent, curcin, which has no effect on blood globules *in vitro,* but which does harm to blood vessels *in vivo*, and, above all, probably has a toxic effect by lodging in important brain centres (in the same way as ricin).

(2) *Curcas oil.*—The poisonous properties of this are due to curcanic acid, produced in an analogous manner to crotonic acid. In consequence of its content of curcanic acid it is one of the strongest drastic substances known and when curcas seeds are taken internally the curcanic acid causes entero-gastritis both in man and animals.

Dried Yeast as a Food for Stock.—In the May, 1913, issue of the Bulletin of Agricultural Intelligence and Plant Diseases, Dr. F. Hayduck, of the Institute of Fermentation Industries and Starch-making, Berlin, gives an account of the development of the dried yeast industry in Germany, and points out the value which this by-product possesses as a food for all classes of farm stock. Fresh yeast has been fed to cattle and pigs with excellent results on farms in the immediate neighbourhood of breweries, but since the drying process has been introduced dried yeast can now be procured by all farmers. Dry yeast is described as one of the richest concentrated foods, 55 per cent. of the dry matter being protein. It is very palatable and easily assimilated by all kinds of live stock, and is especially suitable for fattening purposes. It possesses special dietetic properties, and its real value is therefore higher than its calculated food value Experiments conducted at the above Institute resulted in furnishing the following data —

(1) When fed to milch-cows the butter-fat content of the milk was increased.

(2) The health, appearance, and performance of horses were maintained when more than half of their grain ration was replaced by a corresponding quantity of nutritive substance in the form of dried yeast and dried potatoes.

(3) Sheep utilised 94 per cent. of the organic matter, 88 per cent. of the crude protein, and upwards of 100 per cent. of the nitrogen-free extract of the dried yeast,* which was found to have a higher nutritive value than cotton-seed meal

(4) Young pigs fattened readily on a mixture of dried potatoes, dried yeast, and barley, without any dairy by-products.

(5) As a food for the fattening of geese, the production of eggs and good quality flesh, dried yeast was equal to meat meal.

WEEDS AND INSECT AND FUNGUS PESTS.

Factors Affecting Susceptibility to Disease in Plants (*Journ. of Agric. Sci., Vol. v., Part iii., June,* 1913; *G. T. Spinks, B.A., Cambridge.*)—At the present time very little is known of the factors which determine whether a plant will prove immune to disease or not, and as an initial attack on the question experiments were designed with a view to

* This high utilisation figure is due to a better utilisation of the basal ration caused by the addition of yeast.

ascertain what effect the nutrition of a plant had on its susceptibility to disease. Little Joss and Michigan Bronze wheats were grown in water-cultures of varying compositions and in boxes and pots containing soil, to which varying amounts of artificial manures were added. The effects of attacks of *Erysiphe graminis* (Powdery Mildew) and *Puccinia glumarum* (Yellow Rust) on both varieties were observed under the various experimental conditions and the results compared with those obtained in the case of the pot-cultures and manurial plots at Woburn. The following are the conclusions drawn from the investigations:—

Susceptibility to mildew and yellow rust in wheat, and mildew in barley, is increased by providing the plants with large amounts of available nitrogen; ammonium sulphate and sodium nitrate seem to be equally effective in this direction.

Mineral manures, especially potash salts, decrease susceptibility to disease, but cannot counteract the effect of large quantities of nitrogenous manures. Plants receiving only a small amount of nitrogen, even in the presence of only small quantities of phosphates and potash, exhibit a considerable degree of immunity. Lithium salts are effective in producing immunity, while nitrates of lead and zinc render plants extremely susceptible. A variety of wheat which is almost immune to a disease (such as Little Joss to Yellow Rust) tends to retain its immunity even when supplied with excess of nitrogenous manures. Increased immunity does not appear to be due to lack of food material available for the fungus in the host.

Destruction of Dodder (*Le Stazioni Sperimentali Agrarie Italiane, xlvi., Part* 2, *abs. Bull. Bur. Agric. Int., June,* 1913).—These experiments showed the seeds of *Cuscuta arvensis* and *C. trifolii* to be more susceptible to heat than the seeds of clovers. After dry heating, the seeds of these two dodders were found largely to lose their powers of germination; although after being heated to the maximum temperatures at which clovers retain their germinating capacity, a certain number of the dodder seeds remained unhurt, the number being relatively high in the case of *C. trifolii* and very small in that of *C. arvensis*. The following temperatures and periods of heating were found most effective, viz. . 149° F. for two hours, 158° F. for 30 minutes and for one hour, and 167° F. for 30 minutes and for one hour; further investigation is needed to determine which is best. Clover seeds remained unharmed when exposed dry to these temperatures.

Eradication of Wild Radish by Calcium Cyanamide (*Deut. Landw. Presse, August 24th,* 1912)—The field on which the experiment was carried out was a well-drained medium loam under oats following winter wheat. A good dressing of nitrate of soda was given, and superphosphate was given on March 20th, and the oats sown on March 27th, the young plants appearing on April 12th. As wild radish subsequently appeared in the field in large numbers it was decided to try the effect of calcium cyanamide, and at the end of April at 6 a.m., while the dew was still on the plants, this manure was distributed over half of the field at the rate of about 150 lb. per acre, the other half of the field being left untreated. This amount was used in order to discover whether the large total dressing of nitrogenous manure would have any deleterious effect on the crop.

A few days after the application of the calcium cyanamide the oats went very dark in colour on the treated part of the field, and the wild radish was totally destroyed. The oats on the treated half afterwards came up thicker and in better condition than those on the untreated half. The large nitrogenous manuring caused, however, a retardation —to the extent of eight days—in ripening, compared with the untreated portion. The treated oats showed no tendency to lodge.

After harvesting, the yield, both of grain and straw, from the treated part was half as much again per acre as that from the untreated part. The yields were valued, and after deducting the cost of the calcium cyanamide, the net profit due to the use of this manure was found to be £2 15s. per acre. The quantity of calcium cyanamide used was excessive, and in similar experiments in Germany good results have been obtained from 80 lb. per acre.

Finger-and-Toe in Swedes (*County Agric. Expt. Sta., Cockle Park, Northumberland, Bull. No.* 18, 1912, *and No.* 19, 1913).—Additional plots, alongside the existing ones, were laid down for 1911, and lime in various forms applied. Details as to the nature and amount of dressing applied and the crops obtained in 1911 and 1912 respectively are given. Earlier reports have been summarised in the *Journal* for September, 1912, for April, 1911, p. 47, and for January, 1910, p. 856.

POULTRY

The Utility Poultry Club's Twelve Months' Laying Competition.—The report for the eleventh period of four weeks states that the positions of the three leading pens remain the same as last month. The total number of eggs laid by the leading pen of six White Wyandottes is 1,180, valued at £5 15*s*. 9*d*. A pen of Buff Rocks still holds the second position.

The report remarks that although the leading positions are held by White Wyandottes, Buff Rocks, and Leghorns, pens of these breeds are also to be found towards the end of the list which gives the order of merit for the hundred pens competing, thus bearing out the theory that egg-production is more a question of "strain" than of breed. The records of the six leading pens to the end of the eleventh period are as follows:—

Order.	No of Pen	Breed	Total Eggs for 44 weeks	Total Money Value. £ *s* *d*
1	60	White Wyandottes	1,180	5 15 9
2	86	Buff Rocks ..	1,045	5 8 $3\frac{1}{2}$
3	32	White Wyandottes	1,099	5 5 $0\frac{3}{4}$
4	29	" " .	1,066	4 17 $0\frac{1}{2}$
5	24	Black Leghorns ..	973	4 14 $5\frac{1}{8}$
6	45	White Wyandottes	973	4 13 $11\frac{3}{4}$

Poultry Experiments (*The Pennsylvania State College Agricultural Experiment Station, Bulletin* 120).—This Bulletin contains an account of certain experiments (1) on the treatment of eggs held for hatching;

(2) on crude fibre in the ration of laying hens; (3) on a comparison of simple rations with variety in feeding laying hens.

With regard to the treatment of eggs held for hatching, it is suggested that the daily warming, by contact with the hen's body, which eggs receive under natural conditions when the process of incubation is delayed, appears to have an important influence on the life and vigour of the embryo chick.

A summary of the results of tests carried out in 1910 and 1911 with a view to investigate this question shows that the average number of chicks hatched in incubators from a hundred eggs, which had been held prior to incubation for periods varying from 14 to 30 days, and which were not warmed, was 33; from a hundred similar eggs which had been warmed under hens for sixty minutes daily, 43 chickens were hatched, being a gain of 10 per cent on all eggs used. No particular advantage was apparent from warming eggs that were held for a period of not more than ten or twelve days. It is contended that in handling the eggs in the incubators, the embryos of the warmed eggs, after being placed in the machine, presented a distinctly different appearance from those of eggs not warmed, being larger in size at the same period of incubation and appearing more vigorous. To be of practical value the warming of eggs reserved for hatching would require special apparatus, as it was found difficult to secure a proper temperature for the purpose by the use of incubators.

Experiments conducted in connection with washing eggs which were subsequently used for hatching, indicated that the "hatchability" of eggs was materially reduced by washing.

Animal Foods as they affect Egg-Production and the Hatching Qualities of the Egg (*Ontario Agric Coll. Report*, 1912)—With a view of ascertaining what effect various kinds and quantities of animal food might have on the production and hatching power of eggs, an experiment was commenced in 1909; 125 Buff Orpington pullets were experimented with during the first year, 125 Rhode Island Red hens and pullets in 1910–11, and 100 Leghorn pullets in 1911–12. The animal foods used were buttermilk, 10 per cent. dry mash beef scrap, beef scrap in hopper, and green cut bone. It was found that buttermilk produced the most and the cheapest eggs Where beef scrap was fed in the hopper the Leghorns and Rhode Island Reds did much better than the Orpingtons. In all cases birds which received no animal food produced the smallest number of eggs, but these eggs had the greatest hatching power. The Leghorns supplied with the ration containing no animal food developed the habit of feather-eating to a great extent, and of the three breeds they appeared to be most in need of this class of food.

MISCELLANEOUS

Destruction of Field Mice (*Prak. Bl. fur Pflanzenbau und-Schutz, Dec.*, 1912).—Accounts of the experiments carried out by the Agricultural and Botanical Institute at Munich have been previously given in this *Journal* for Jan., 1911, p 861, and Jan., 1912, p. 864. Experiments with various substances were continued in 1912, and the conclusion drawn from them is that the pest can be prevented from attaining the dimensions of a plague if farmers will only undertake systematic

measures for its eradication in spring before seeding and in autumn after harvest. The most reliable remedies were found to be direct poisons—in this case, strychnine and barium carbonate.

The method of application was as follows:—A long tube, provided at its upper end with a funnel, was inserted in the mouse-hole, and grain poisoned with one of the substances used was poured down the tube. The results from phosphorus were very variable; apparently mice will not eat grain poisoned by phosphorus in wet weather.

Carbon bisulphide gave as good results as the above poisons, but special apparatus has to be used in its application in order to guard again the risk of an explosion. Apart from the apparatus, the cost of the treatment was no greater than in the case of the poisons.

Good results were also obtained in unfavourable weather conditions in late summer and autumn with a rat virus. It is recommended, however, that the treatment should be combined with poisons, as thereby some of the mice will be killed at once, while others will infect immigrating mice.

Fumigation other than with carbon bisulphide did not give very satisfactory results. It is found impossible in practice to close up all mice-holes, and the process is costly both in money and labour.

Destruction of Voles in France (*Bull. Mens. de l'Off. Rens. Agric., April,* 1913).—In consequence of the damage done by voles in the eastern districts of France in 1912, the Government sanctioned a vote of £10,000 for the purpose of supplying a virus known as "Danysz," manufactured by the Pasteur Institute.

The use of this virus was not attended with very satisfactory results, and, on the attention of the Ministry of Agriculture being called to another virus, "Le Ratin," an experiment was organised with the latter virus, twenty-four plots of a total area of 2·3 acres being selected. These plots were distributed over a badly infested area of 30,000 acres. The result of the treatment was that, on all the plots, 321 dead and 178 living voles were found, *i.e.*, there was a mortality of about 70 per cent. It is considered that, taking into account the rate of reproduction of the voles, a mortality of 90 per cent. must be attained for the treatment to be satisfactory—a result which was obtained on four plots only. The virus was most effective on pasture and old stubble. It was concluded that while "Le Ratin" might be classed among the preparations useful for the extermination of voles, no general use of the virus could be recommended.

Incidentally, the experiment confirmed previous experience to the effect that treatment on a large scale leads to an emigration of the pests. The existence of permanent breeding grounds was also demonstrated, where the pests may remain dormant for a time, and from which they may spread as a result of the occurrence of conditions which are, however, still ill-defined. It is suggested that energetic measures should be taken for the discovery and eradication of these breeding places.

NOTES ON AGRICULTURAL CO-OPERATION AND SMALL HOLDINGS.

Bedfordshire Shorthorn Bull Scheme.

In 1905 the Bedfordshire Agricultural Society adopted a scheme for the provision of pure-bred Shorthorn bulls, selected from good milking strains, with the object of assisting breeders of cattle in the county to improve their herds. The Duke of Bedford subscribed £500 for the purchase of the first twelve bulls, and promised a further subscription of £100 per annum for three years towards the expenses. Other subscriptions were also guaranteed for three years by sympathisers with the scheme.

At first, the arrangement made for the keep of the bulls was that they were put in charge of selected farmers, who were paid 10*s*. per week, and who paid for the bulls' services at the same rate as other members. The cost of nomination was 4*s*. to members of the Society and to agriculturists farming under fifty acres of land, and to others 8*s*. each. This plan, however, was found to be too expensive, and in 1906 it was arranged that the farmers who kept the bulls should keep them free of cost to the Society, in return for the privilege of having the free services of the bulls for their own cows. At the same time the nomination fee was reduced to 2*s*. 6*d*. to members of the Society and to agriculturists farming under 100 acres, 8*s*. being charged to all others. Again, in 1910, it was found that the farmers who kept the bulls were not sufficiently remunerated by the privilege of free service for their own cows, and it was then decided that all nomination fees should be retained by the respective bull-keepers. This arrangement still holds good, so that at present, while the Society incurs no charges in respect of the keep of the bulls, it on the other hand receives no income for the use of the bulls, either from the bull-keepers or from others.

The bulls are purchased by a Committee of three stock-and-dairy farmers, who visit well-known herds and attend sales at Birmingham and elsewhere, and select young bulls from first-class milking-herds after inspection of their dams and of the milk records available, the selected bulls being required to pass a veterinary examination and a test for tuberculosis.

The farmer who arranges to keep a bull enters into an agreement binding him to keep it free of cost to the Society, to feed it properly and keep it in good store condition, and to have it well attended to and exercised daily. He also agrees to allow only such cows, including his own property, to be served by the bull as shall be accompanied by a nomination form signed by the Secretary of the Society. In this nomination form the owner of the cow is required to sign a declaration that the cow is his property, that she has not aborted within twelve months past, and that she has not been served by any other bull within a period of six weeks; and he renders himself liable to a penalty of £10 if this declaration is found to be untrue.

The experience of the Society may be summed up as follows :—On

the average of the five years ending 1912, the Society had nine bulls used by 113 owners of cows, the average number of cows served per bull being 67. During that period it purchased altogether 22 bulls at a total cost of £630, an average of £28 13*s.* per bull, and sold altogether 21 bulls at a total price of £322, an average of £15 7*s.* per bull. Thus the actual average loss on the purchase and sale of a bull was £13 6*s.* Fuller details are available regarding the last ten bulls sold. They cost altogether £292, an average of £29 4*s.*, and were sold for £131, an average of £13 2*s.*, so that the average loss on the purchase and sale of these ten bulls was £16 2*s.* (The highest price paid for one of these bulls was £39 18*s.*, and the lowest £20; the highest price obtained on sale was £22 15*s.* for an animal fed for the market, and the lowest 15*s.* for the carcass of an animal that died from blood-poisoning.) The average time during which these ten bulls were kept in use was two years and four months, the longest period being nearly four years, and the shortest seven months. Two of them were sold as still fit for stock-getting, two as being too wild to keep, four on account of disease, and two because they did not hold their cows. If the average loss of £16 2*s.* per bull be spread over 2⅓ years, the average period during which a bull was used as a sire, it gives £6 18*s.* as the average loss per bull per annum actually incurred by the Society on these ten bulls. To judge from this experience, it would seem advisable for a similar Society to provide for an annual loss by depreciation of £7 per bull.

The average age when bought of the ten bulls at present held by the Society was 19 months, the youngest being 11 months and the oldest 2 years and 5 months old. It is usual to begin using a bull for heifers when he is 16 months old, but a heifer is not sent to the bull till she is nearly two years old. Last year the average number of cows served per bull was 62, the highest number being 86, and the lowest 33. Four of the ten bulls served more than 70 cows each.

Apart from the income on the sale of bulls, the income of the Society has, for the last four years, averaged as follows:—

	£	*s*	*d*
Interest	14	8	2
Contributions	75	0	0
Miscellaneous	0	7	11
Nominations and Subscriptions	15	9	8
	£105	5	9

Apart from the expenditure on the purchase of bulls, the average expenditure for the last four years has been:—

	£	*s*	*d*
Selection and Inspection Committee's Expenses	12	19	4
Secretary's Honorarium	25	0	0
Veterinary Surgeon's Fees	6	2	0
Other Expenses	7	12	10
	£51	14	2

The average excess of income over expenditure (excluding the purchase and sale of bulls) has therefore averaged for the last four years £53 11*s.* 7*d.*

Since the year 1909 the Society has received no income from nomination fees (which have gone to the bull-keepers) or from subscriptions from supporters, and since 1910 it has received only £50 a year from the Bedfordshire Agricultural Society in place of the £100 a year it formerly received from this source. Thus it has been on its present financial basis for the last two years only, and it is instructive to consider the history of this period At the beginning of these two years it possessed bulls valued at £213, and at the end the bulls were valued at £187—a loss of £26. During the two years the Society spent £242 in the purchase of bulls, and received £119 on the sale of bulls—a net expenditure of £123. When to this is added the £26 lost on valuation of stock, the net loss to the Society on its bulls during the last two years was £149, giving an average of £74 per annum lost under this head. Its income other than that from the sale of bulls averaged £66, of which £16 came from interest and £50 from the Agricultural Society. Its expenditure, other than the cost of bulls purchased, averaged £52, including £12 for the expenses of the Selection Committee, £25 secretary's salary, £8 veterinary fees, and £7 miscellaneous expenses Adding to this the £74 lost on the sale and purchase of bulls, gives a total net expenditure to be met of £126 per annum against an income averaging only £66, leaving a net loss of £60 per annum. Besides this, the Society had to write down the value of its investment in Consols by £18, which gives an average of £9 per annum, thus increasing the total loss to £69 per annum. The balance-sheet shows a decrease in the net assets during this period from £821 to £680—a loss in the two years of £141. Thus it would seem that on its present footing, to judge by the experience of the last two years, the Society is likely to lose about £70 per annum, and to see its assets steadily diminish at this rate.

Its present assets of £680 are made up as follows —

	£
Present value of Bulls	187
Value of investment in Consols	352
Deposit in Savings Bank £150 (less overdraft at Bank of £9)	141
	£680

The accumulation of these assets is mainly due to the gift of £500 made to the Society by the Duke of Bedford at the start and to the liberal subscriptions given by well-wishers in its early years.

To place the Society on a self-supporting basis as things now stand, and to enable it to maintain its present number of ten bulls, it would be necessary to provide an annual income to meet the depreciation of the bulls of £70 per annum, at the rate of £7 per bull, besides £52 to meet the expenses of management at the present high rate of over £5 per bull, or a total of £122 per annum. Against this the annual income other than service-fees would be £15 from interest, leaving a net amount of £107 per annum, or say £10 per bull, to be made up from service-fees. On the average of the last five years the number of cows served per bull has been 67, and if we suppose that the Committee can raise this average to 70, and, like the Leicestershire Society, can get a farmer to keep a bull in return for free services for 30 cows, that will leave 40 cows per bull on which service-

fees might be charged; and to raise an income of £10 per bull from these 40 cows, it would be necessary to charge a service-fee of 5*s.* per cow. So long as the Agricultural Society continues its present subscription of £50, a service-fee of 2*s.* 6*d.* per cow on an average of 40 cows would be enough to keep the scheme going without any depreciation of its net assets. It is reported that the scheme has resulted in a marked improvement in the stock kept by the farmers who have used the Society's bulls, and in the prices obtained for the calves, so that it would seem to be well worth the while of owners of cows to pay 5*s.* a service for one of these pedigree bulls.

Bedfordshire Shire Horse Society.

This Society was started in 1890 for the purpose of improving the breed of Shire horses in the district by obtaining the services of first-class registered sires The annual subscription for membership is 5*s.* The affairs of the Society are managed by a Committee of twelve, with a president, vice-president, secretary, treasurer, and auditor—all elected at the annual meeting held every January. The Committee have full power to conduct the business of the Society, including the provision of a horse or horses, as well as all arrangements connected with the route, nominations, and service-fees, and the holding of a Foal Show. Application for the nomination of mares must be sent in to the honorary secretary before April 1st in each year, accompanied by a remittance of the fee fixed by the Committee for each nomination applied for.

The Committee have secured the services of one pedigree Shire stallion each season since 1890. He is chosen by a selection committee at a rate of hire agreed upon with his owner, generally payable in two instalments in May and August. The season lasts from the beginning of April to the middle of July, and the number of mares to be served is generally fixed at 110. The owner agrees to exhibit the selected stallion at the Bedford Stallion Show in April; to pay over to the Society any money prizes he may be awarded there; to provide a groom to travel with the horse; to pay all expenses of both horse and man; and to take all risks The owner is bound to provide another horse approved by the Committee as a substitute for the horse first selected if he should be incapacitated from successfully fulfilling the agreement The groom has sole care and charge of the horse subject to the reasonable orders of the secretary and the Committee, and is to receive no fees. The stallion is to serve no mares unless a nomination card signed by the secretary is duly presented. The groom has to decide when mares are fit for service, and has power to refuse the services of the horse to any mare he may consider unfit from any cause whatever The owner of the stallion is not responsible for accident to mares through being tried or served.

During the last six years the Society has charged for service-fees the sum of £2 10*s.*, while the amount paid for the hire of the horse has usually been £270 or £275, the actual average being £262, as in one year the full amount agreed on was not paid owing to the breakdown of a horse. The service-fees realised averaged £283 per annum, or about £2 12*s.* per service, the number of mares served per season having averaged 110, and varying from 85 in the year of the breakdown to

120 last year. The average number of mares left in foal was about 76. The average income and expenditure have been as follows:—

Income—		£
	Service-fees ...	283
	Foal Show Receipts .	23
	*Subscriptions and Donations	88
	Total income	£394

* The donations are given principally towards the Foal Show expenses.

Expenditure—		£
	Hire of Stallion	262
	Selection Committee's Expenses	12
	Veterinary Surgeon's Fees	3
	Honorarium to Secretary	13
	Foal Show Expenses	81
	Miscellaneous	17
	Total expenditure	£388

Thus on the average the income has exceeded the expenditure by £6 a year, and the assets of the Society have increased during the six years from £147 to £184, which on December 31st last stood to the Society's credit at the bank.

Last year there were 98 members whose subscriptions amounted to about £25, so that the donations to the Society seem to have averaged about £63. Deducting this sum and the show receipts and expenditure, the account would stand as follows:—

Income—		£
	Service-fees	283
	Subscriptions	25
	Total income	£308
Expenditure—		£
	Hire of Stallion	262
	Expenses of Management	45
	Total expenditure	£307

So that, as a Stallion Society pure and simple, this Society would appear to be on a self-supporting basis. It has, at a cost of 5*s.* a year membership subscription and £2 10*s.* service-fee, secured for its members the use of a pedigree stallion, valued at from £600 to £1,200, according to the age and quality of the horse selected, which is reported to have resulted in a marked improvement in the quality of the Shire stock owned by the farmers of the county.

Co-operative Purchase and Use of Stallions in Denmark.*

The procedure usually followed in Denmark by an association for the co-operative purchase and use of stallions is as follows:—After the members have formed themselves into a society, the price of the stallion to be obtained is agreed upon, and arrangements are made for the purchase price to be paid by yearly instalments, the members being jointly responsible for the payment.

* Report to the Board by His Majesty's Chargé d'Affaires at Copenhagen.

Members pay no association subscription. An association normally consists of about 80 to 100 members, *i.e.*, about as many as may make use of one stallion. Some associations have as many as two to three hundred members and own two to three good stallions, whilst other associations, especially in the islands, have only fifty members at the most.

An idea of the average price of the stallions and the length of time that they are kept by the society may be obtained from the following particulars relating to four associations:—

Society.	Year of Foundation.	No. of Members.	No. of Stallions owned up to present time.	Average Purchase Price
				£
1	1888	110	7	472
2	1888	225	10	344
3	1888	134	7	355
4	1888	309	11	500

The stud fee, if there is a satisfactory result, is, as a rule, from £1 2s. to £1 13s., which increases to as much as £2 15s. for the best stallions, the purchase price of which is from £1,111 to £1,666.

The cost for stabling and fodder amounts to £39 or £44, and more for the best stallions. The stallions are kept at a central establishment. The number of mares covered as a rule by one stallion is from 100 to 150, and for the best stallions up to 200, but rarely more.

Among other objects, the Horse Breeders' Associations judge mares at shows in accordance with the cattle law of 1912. These shows take place before the breeding period under the direction of a Government official (Statskonsulent) or his substitute, who is chosen in each county by the joint committee of the Horse Breeders' Association, together with two judges elected also by the association.

The mares are placed in the first or second class, and thereafter it is obligatory for them to be covered by a prize stallion. The first-class mares are entered in a pedigree book, provided their pedigree and foals satisfy the standard requirements.

The judging of stallions, which is also carried out by the above-mentioned joint committee, is not compulsory according to law, but is necessary if it is desired to obtain a State prize for three or four-year-olds. Judging is carried out in various convenient centres during the month of March.

There are 300 Horse Breeders' Associations in Denmark—one for each district—and they are amalgamated in joint committees, of which the principal is the Jutland Co-operative Horse Breeders' Association, which was founded in 1888, and which includes about 200 associations with about 21,000 members, and owning more than 200 stallions exclusively of the Jutland breed.

The Danish Cattle Law of 1887 authorised the Government to give State grants to Horse Breeders' Associations of up to one-half of the purchase price of a good stallion, with a maximum grant per stallion of £222. There were 267 associations in 1911–12 subsidised by the State,

owning 281 stallions, and the Government grant to them was £9,360. The Cattle Law of 1912 has, however, reduced the State subsidy to one-half that formerly granted, *i.e.*, the maximum amount for each stallion is now £111, and the requirements to obtain the State grant have been made more difficult. This will probably reduce the number of less good associations which have almost entirely existed on State grants in the past.

The Experience of Animal Insurance Societies in Holland.

From statistics relating to animal insurance societies in Holland, recently published by the Dutch Ministry of Agriculture (Verslag over den Landbouw in Nederland over 1912), it is possible to obtain some knowledge as to the experience of these societies in 1911 and to compare it with that of English societies in the same year.

The average size of the holdings in the two countries may first be considered. In Holland in 1910 there were 109,605 holdings of from 2½ to 12½ acres; 41,439 from 12½ to 25 acres; 30,821 from 25 to 50 acres; 23,797 from 50 to 125 acres; 3,278 from 125 to 250 acres; and 216 over 250 acres In England and Wales in 1912 there were 92,198 holdings from 1 to 5 acres in size, 200,522 from 5 to 50 acres, 128,594 from 50–300 acres; and 14,572 holdings over 300 acres. Thus in Holland there were 181,865 holdings from 2½ to 50 acres in size in 1910, while in England and Wales in 1912 there were 292,720 holdings between 1 and 50 acres in size The average size of the total number of holdings was approximately 25 acres in Holland and 60 acres in England and Wales.

Cattle Insurance Societies.—The cattle insurance societies in Holland usually insure all kinds of horned cattle above a certain age, but a number of them are confined exclusively to milch cows. Most of the societies require their members to insure all their healthy cattle above a certain age, except those fattened for slaughter. There were, in 1911, 885 such societies, with 89,748 members and 377,540 insured animals, so that, on an average, a Dutch cattle insurance society consists of 101 members, each of whom insures 4.2 cows The 22 registered cow clubs in England and Wales in 1911 had an average of 69 members, each of whom insured 3.0 animals The death-rate in 1911 in Holland was 2.8 per cent., in England 2.6 per cent. (2.2 per cent. in 1910).

Fuller details are possible for Holland for 1911 with regard to 488 societies These had 54,409 members, 199,693 insured animals of the value of £2,288,890, the number of deaths was 4,573 (an average death-rate of 2.3 per cent), and £41,790 was paid in compensation The average value of an insured animal was therefore £11 10*s*., and the average amount paid per animal that died £9 3*s*., so that on the reasonable assumption that these were average animals, the societies paid on an average 80 per cent. of the value of animals that died. In England and Wales in 1911 the average loss per cow that died was £8 7*s*. (£8 15*s*. in 1910). In Holland it will be seen that the losses in 1911 would have been covered by a premium of 4*s*. 3*d* (or 1.9 per cent.) per animal insured The loss per animal insured in England and Wales in 1911 was 4*s*. 4*d*. (4*s*. in 1910), but the premiums levied

averaged only 4*s.* 2*d.*, the other 2*d.* being covered by income from interest and other sources.

The Dutch societies do not, however, as a rule, levy fixed premiums, the requisite funds being most commonly collected by a contribution in proportion to the losses sustained on the insured value. Although entrance fees are customary, the expenses of the societies, beyond the compensation for animals that die, are very small. The director or secretary of the society occasionally receives some small remuneration, but usually only his out-of-pocket expenses are paid, and this is the case with valuers and other officers.

Pig Insurance Clubs.—Pig insurance societies in Holland usually accept all pigs above the age of from two to six weeks. In 1911, 107 societies with 10,353 members had 25,575 pigs insured, so that on the average each society consisted of 97 members and each member insured 2·5 pigs. In England and Wales in 1911, on the other hand, 31 registered pig clubs had an average membership of 52, and the average number of insured pigs per member was 1·7.

The death-rate in Holland was 6·0 per cent., compared with 4·2 per cent. in England and Wales (and only 3·3 per cent. in 1910) The amount paid in compensation in Holland was equivalent to £1 2*s.* 2*d.* per pig that died and to a premium of 1*s.* 4*d.* per animal insured.

The average loss in England and Wales in 1911 (after deducting the amount received for carcasses) was £2 3*s.* per pig that died and nearly 1*s.* 10*d.* per pig insured. The much higher death-rate in Holland, and the smaller amount paid at death by Dutch societies, is to be ascribed, no doubt, either wholly or in part, to the much younger age at which Dutch societies accept pigs for insurance.

Horse Insurance Societies.—It may be of interest to give particulars of the horse insurance societies, although there are no English statistics with which to compare them. There were, in 1911, 523 societies with 48,549 members and 90,602 insured animals, giving an average membership of 93 and an average number of insured animals per member of 1·9. The value of the animals averaged £24 The death-rate was 3·0 per cent , and the compensation paid amounted to £16 11*s.* per horse that died (*i.e.*, on an average, 69 per cent of its value), and 10*s.* 1*d.* per animal insured (equal to a premium of 2·1 per cent). The amount actually paid in compensation by different societies varies from 50 to 95 per cent , and the premiums actually charged vary from 1½ to 3 per cent of the insured value.

Scheme for the Improvement of Live Stock.

The Lords Commissioners of His Majesty's Treasury have agreed, on the recommendation of the Development Commissioners, to make an advance to the Board of Agriculture and Fisheries of £37,000 (exclusive of provision for clerical and accounting work at the offices of the Board), by way of grant from the Development Fund, in aid of the improvement of live stock in England and Wales for the current financial year.

The main object of the scheme is to afford means of demonstrating to groups of farmers, especially the smaller farmers, that it is sound economy and of pecuniary advantage to use only sound and high-

class sires, and to keep records of the milk yield of their dairy cows with a view to getting rid of poor milkers and improving by judicious selection and breeding the productiveness of their herds. Preference in the assistance contemplated is to be given, as far as possible, to occupiers of agricultural holdings, which either do not exceed 100 acres in extent or, if exceeding 100 acres, are of an annual value for purposes of income tax not exceeding £100.

The assistance will take the form of financial help for the provision of high-class bulls, stallions, and boars, at the same low fees as are usually paid for the use of an inferior type of sire, and the Board are also authorised to pay one-half of the expenses of associations of farmers, formed for the purpose of taking and checking the milking records of the herds of their members, but such grant is not to exceed £50 to each association. Where, however, a society is in a position advantageously to employ more than one tester, the Board will be prepared favourably to consider a relaxation of this limitation.

It is prescribed by the conditions attached by the Development Commissioners to the grant that the provision of stallions and boars, and, wherever possible, the provision of bulls, is to be made through the medium of clubs and societies, which may either be already in existence, or be specially formed for the purpose, as the Commissioners consider that the formation of societies will afford the best means of enabling small farmers to realise the advantages of co-operating, and of securing thereby the services of high-class sires, which as isolated individuals they might not be able under existing circumstances to obtain In regard to bulls, it is recognised that in some districts it may not be possible at once to form clubs and societies for their provision, and where this is found to be the case, grants may be offered to individual breeders who are willing to place approved bulls at the disposal of their neighbours.

It is not intended, however, that the offer of grants to individuals for the provision of bulls shall be continued for so long a period as that of grants to clubs

The total amount of financial assistance which the Board are authorised to give in one year under the various parts of this Live Stock Improvement scheme is as follows:—

(1) Grants to societies or individuals for the provision of bulls	£13,800
(2) Grants to societies for the provision of boars ..	£1,000
(3) Grants to heavy-horse societies	£8,800
(4) Grants to milk-recording societies ..	£5,000
(5) Grants to the selected agricultural institutions for the employment of Live Stock Officers ..	£8,400
	£37,000

The Board have divided the grant between England and Wales in proportion to the estimated numbers of holdings above twenty and not exceeding 100 acres—namely, 81 and 19 per cent. to each country respectively, and they have apportioned the amount available for

England between the ten provinces into which the country has been divided, in accordance with the distribution of animals between those districts.

Grants for Bulls.—Grants for the provision of bulls will be made on the following conditions:—

(1) No grant exceeding £12 per annum is to be made to any individual bull owner, or exceeding £15 per annum to any club or society.

(2) Not more than four annual grants of £12 are to be made to any individual; and not more than five annual grants of £15 to any society for each approved bull provided by it.

(3) Grants are only to be made to individuals when the Live Stock Officer in the area concerned is satisfied after full inquiry that it is not possible to form a bull club for a district in which the provision of a good bull is necessary.

(4) No grant is to be made to any individual in respect of a bull owned by him before this scheme comes into operation unless the Live Stock Officer is satisfied that in return for the grant the bull can and will be made available to an appreciably greater number of cows belonging to small farmers than it now serves.

(5) Not more than one-third of the sum available for grants in any one year is to be spent in grants to individuals.

No grants to individuals will be made in respect of any year after 1918–19, or in excess of a total sum of £25,000 from the beginning of the scheme, and no grants will be made after the year 1918–19, except to clubs or societies formed since the commencement of the scheme which have not received the full number of grants authorised by the second condition above.

After the year 1918–19 assistance by way of loans, repayable without interest, will be available if the financial position of the Development Fund warrants it.

Grants for Boars.—Grants in aid of the provision of boars will be made to societies only. The amount of the grant will be one of £4 for each approved boar provided, for the first year, and £2 for the second year.

Grants to Heavy Horse Societies.—Grants will be made to heavy horse stallion societies on the following conditions:—

(1) No grants shall be given to societies which hire stallions to travel at a fee exceeding £3 3*s*.

(2) In no case shall the grant to a society exceed £80 for each approved stallion provided by it, of which not more than £40 may be a direct grant, the remainder being utilised, if necessary, for "assisted nominations."

(3) Except in the case of "assisted nominations" no reduction in the amount of the service fee usually charged shall be made by the societies receiving grants.

(4) The stallions hired by societies receiving grants shall be approved by competent experts, and registered under the Board's scheme for the registration of stallions; and the mares for which assisted nominations are given shall be approved by the society as suitable for the purpose.

(5) The rules of the societies receiving grants shall be approved by the Board.

Grants to Milk-Recording Societies.—Grants will be made to milk-recording societies on the following conditions:—

(1) Preferential consideration shall be given to societies already formed on a co-operative basis.

(2) The societies receiving grants shall employ "testers" to check or take the milk records at proper intervals.

(3) No society shall receive a grant exceeding £50 annually or exceeding one-half the expenditure incurred by it, and no society shall continue to receive a maximum subsidy for more than two years

The appointment of the testers will have to be considered and receive the approval of the Live Stock Committee of the Advisory Council.

Live Stock Officers.—Grants will be made for the salaries and expenses of a Live Stock Officer to be attached to each of the selected agricultural institutions in the twelve provinces of England and Wales.

This Officer will be primarily responsible for the local promotion and administration of the Live Stock Scheme in the area for which he is appointed He will also be required to give technical advice and assistance to local agriculturists, and to members of the county staff on questions relating to live stock.

Administration.—The advisory work in connection with the scheme will be entrusted to the Advisory Councils that have been set up in the ten provinces into which England has been divided, and to the Welsh Agricultural Council in Wales.

These Advisory Councils are to be composed of nominees (1) of the Selected Agricultural Institutions in the provinces, (2) of the County Education Committee, and (3) of the Board. Each Advisory Council will appoint a Live Stock Committee, who will act as the advisory body in connection with the Live Stock Scheme with power to approve schemes prepared by the County Live Stock Committees and to submit such schemes to the Board for approval.

The duties of a Live Stock Committee of an Advisory Council will be (1) to make recommendations to the Board in respect of the allocation of the various grants amongst the counties comprised in the province for which they are appointed, (2) to advise the Board on the conditions to be attached to the grants to be given towards the cost of hiring or purchasing suitable male animals, (3) to advise the Board generally on the operation of the scheme, on the results obtained from it, and on any other questions in connection with the improvement of live stock on which the Board may deem it advisable to consult them, (4) to appoint such sub-committees as they may consider necessary to assist them in the conduct of their business.

The Live Stock Officer of the province will act as secretary to the Live Stock Committee of the Advisory Council.

The administrative body will be a County Live Stock Committee in each county, and it will be constituted as follows:—

(1) The county members of the Live Stock Committee of the province, one of whom shall act as chairman.

(2) Two members, either of the County Agricultural Education Committee or Sub-committee of the County Council, to be nominated by the County Council.

(3) Not less than two practical stock breeders to be appointed by

the above members of this committee, and at least one member of any recognised County Breed Society within the province (if the society is not already represented on the County Live Stock Committee), such member to be nominated by the breed society concerned.

(4) The Live Stock Officer of the province, with the consent of the County Council, the Agricultural Organiser of the county, and the county land agent will be present at the meetings.

The County Live Stock Committee may appoint such sub-committees as they think fit, and the County Councils will be invited by the Board to provide clerical assistance and a room for meetings.

The general procedure under the scheme will be as follows:—

(1) The Board will inform the Live Stock Committee of the Advisory Council of each province of the amount of the grant allocated to the province.

(2) The Live Stock Committee of the Advisory Council will decide the amount to be allocated to each county and will inform the County Live Stock Committee.

(3) The County Live Stock Committee will prepare a scheme for dealing with the grants allotted to their county, and will submit it to the Board for approval through the Live Stock Committee of the Advisory Council of the province.

(4) The animals will be selected and approved by a Selection Committee or Committees appointed by the County Live Stock Committee. The Live Stock Officer of the province shall be a member of each Selection Committee, and the County Live Stock Committee may appoint on the Selection Committee or Committees such properly qualified persons as they may think fit.

(5) Applications for grants are to be made to the Live Stock Officer of the province.

(6) The Board will make the grants recommended by the County Live Stock Committee direct to the society or individual concerned, and they reserve the right to approve any animal before it is accepted as being suitable for the purpose of the scheme.

The Board will issue in due course rules and regulations to give effect to the scheme, and the Development Commissioners desire that it should be clearly understood that the scheme, in so far as it provides temporarily for grants, whether to individuals or to societies, makes such provision for the purpose of giving a practical demonstration to convince farmers, and particularly small holders, that it is sound economy to pay for the use of a good sire, and that the scheme will be converted at the end of 1918–19 into a system of loans to societies, unless it then appears that that purpose has not been attained.

The Development Commissioners also wish it to be understood that all grants or loans for future years are subject to the general conditions (*a*) that the working of the scheme is satisfactory, (*b*) that in the opinion of the Commissioners the financial position of the Development Fund warrants the expenditure.

OFFICIAL NOTICES AND CIRCULARS.

The Board have published the following new leaflets during the present year:—

Leaflets in 1913.

No. 266, *Ropy Milk*; No. 268, *The Cultivation of Field Beans*; No. 269, *Diseases of Raspberry and Loganberry*; No. 270, *The Sale of Low-quality Manures at Excessive Prices*; No. 271, *Clover Sickness*; No 272, *Supply of Store Cattle and Slaughter of Young Calves*; No. 273, *"White Heads" or "Take-All" of Wheat and Oats*; No. 274, *Parasitic Mange in Horses, Asses, and Mules*; No. 275, *Improvement of Poor Hill Pasture.*

New editions of the following leaflets have been issued, the information in them having been revised—in a number of cases to a considerable extent.—

No. 2.—*Vine, Plum, Hop, and Raspberry Weevils.*

No. 3.—*"Flea" Beetles.*

No. 4.—*Winter Moths.*

No. 8.—*Assessments to Local Rates.*

(The Welsh edition of Leaflet No. 8 has also been revised)

No 10—*Wireworms.*

No. 12—*The Gooseberry Saw-fly.*

No. 26.—*Farmers and the Income Tax.* Extended so as to include the Finance (1909–10) Act, 1910.

No. 30.—*The Codling Moth.* The illustrations have been improved.

No 31.—*The Onion Fly.*

No 41—*Red Spiders* The suggested remedies have been extended

No 46—*The Stem Eelworm.* Further methods of dealing with the pest have been added to those already suggested

No. 52—*The European Gooseberry Mildew.*

No. 57.—*External Parasites of Poultry.*

No. 62.—*The Pear and Cherry Saw-fly.* The suggested remedies have been re-arranged and extended.

No. 69—*Tent Caterpillars The Lackey Moth and the Brown Tail Moth.*

No 79—*Rations for Farm Stock* Re-written.

No. 82.—*Preparation of Wool for Market.* The greater part of this leaflet has been re-written, and additional information and advice on the washing and shearing of sheep and selection of dips have been included.

No 93.—*Farmyard Manure.* The English edition has been revised and a Welsh translation issued

No 97—*Farmers' Co-operative Societies* This leaflet has been largely re-written The section dealing with societies for the purchase of farming requirements has been extended, and recent developments in agricultural co-operation are now dealt with in the leaflet.

No 100.—*The Breeding and Management of Pigs.* This leaflet, formerly issued as *Pig Breeding and Feeding*, has been substantially revised, and in parts re-written. Additional advice is given on the management of the sow and feeding of the young pigs.

No 105—*Wart Disease (Black Scab) of Potatoes.*

No 111—*Co-operative Egg and Poultry Societies.* Parts of this

leaflet have been re-written and a paragraph has been added dealing with outlets for the eggs purchased by a society from its members.

No. 114.—*The Feeding of Poultry.*

No. 116.—*Sleepy Disease of Tomatoes.*

No. 129.—*Winter Egg Production.* The English edition has been revised and a Welsh translation issued.

No. 143.—*The Turnip Mud-Beetle.*

No. 147.—*Fences and Hedges.* The part relating to soil, draining, and trenching has been re-written, and paragraphs have been added dealing with the maintenance, binding, and subsequent treatment of hedges.

No. 157.—*The Sale of Newly-hatched Chickens.* A paragraph dealing with turkey chicks has been added.

No. 160.—*The Cultivation of Lucerne.* This leaflet has been re-written and considerably extended in scope. The information relative to soil and climate has been amplified, and paragraphs dealing with the character of the plant, its value to the farmer, and the utilisation of the crop have been added.

No. 163.—*White Rust of Cabbages.*

No 167.—*Ducks and Duck-breeding.*

No 171.—*Rhizoctonia Diseases.* This leaflet, formerly published under the title *Violet Root-Rot,* contains information respecting both *Rhizoctonia violacea* and *R. solani.* A full-page illustration showing diseased potatoes has been added, and the leaflet now covers four pages.

No. 173.—*Potato Growing.*

No. 176.—*Poultry Fattening.* Advice as to killing has been added

No. 184.—*Red, White, and Alsike Clovers.*

No. 187.—*The Selection and Milking of Dairy Cattle.*

No 192.—*Farm Butter-making.* This leaflet has been considerably revised, and in parts re-written. A paragraph dealing with the separation of cream from milk has been included.

No 193.—*Winter-Rot of Potatoes.*—Additional information has been included about the nature and means of spread of the disease

No 194.—*Coltsfoot.*

No. 197.—*Agricultural Education and Research in England and Wales.* As the result of the grants made to the Board from the Development Fund and the increased amounts available from Parliamentary sources for the purposes of agricultural education and research, the information contained in the first edition of this leaflet, issued in 1907 under the title *Agricultural Education in England and Wales,* required alteration in many respects. The present edition has been entirely re-written.

The greater part of the leaflet is devoted to a detailed description of the facilities for agricultural education afforded at various institutions throughout the country. This section is divided up as follows:—(1) Universities and University Colleges, of which seven are described; (2) Agricultural Colleges, of which there are also seven; (3) Special Institutions; (4) Farm Schools, Fixed Dairy Schools, and similar institutions. Information is also given as to the institutions which provide instruction for women The second section gives a list of the subjects in which research is being carried out, and the institutions selected for the purpose. The third section contains a list of the

institutions undertaking the supply of technical advice to farmers and the investigation of local problems. The provision now made for forestry education, research, and advisory work are dealt with, and a list is given showing the name and address of the Advisory Officer for each of the five districts comprising the whole of England and Wales.

No. 198.—*Rearing and Marketing of Geese.*

No. 207.—*Strawberry Cultivation.*

No. 218.—*Associations for the Creation of Small Holdings.* The descriptions of typical small holdings and the statement giving particulars of all associations renting land under the Act have, as far as possible, been brought up to date.

No. 220.—*Agricultural Holdings Act,* 1913. This leaflet supersedes the previous edition entitled *Agricultural Holdings Act,* 1908. The Agricultural Holdings Act, 1913, is intended to remove the doubts as to the effect of the 1908 Act in relation to market garden improvements, which were raised by the decision of the Court of Appeal in the case of *In re* Kedwell and Flint.

No. 222.—*Meadow Saffron.* The revised edition contains some additional remedial measures.

No. 237.—*Redwater in Cattle.* The part describing experiments and research connected with the disease has been amplified

No. 238.—*Leaf Diseases of Celery.*

No. 239.—*The Pear Leaf Blister Mite.*

No. 240.—*Farm Book-keeping.*

No. 244.—*The Destruction of Rats.* Additional information is given as to remedial measures.

No. 249.—"*Couch*" *or* "*Twitch.*"

No. 251.—*Common Weeds.—I. The Corn Marigold, Docks and Sorrels; Goosefoot; Stinging Nettles; Yellow Rattle, Poppies, and Corn Cockle.*

No. 254.—*The Use of Seaweed as Manure.* This leaflet, formerly issued as *The Composition of Seaweed and its Use as Manure,* has been considerably reduced in length by the omission of the part relating to the composition of seaweed and other substances collected with it. A paragraph comparing seaweed with farmyard manure has been added.

No. 255.—*The Workmen's Compensation Act,* 1906 This leaflet has been enlarged by the inclusion of the proceedings for settlement of claims necessary in the case of persons insured under the National Insurance Act.

No 258—*Rural Party Line Telephones.* This has been amended in accordance with the latest facilities of service offered by the Post Office.

The Board of Agriculture and Fisheries desire to draw the attention of owners and other persons concerned with the consignment of stock by rail to the following provisions of the Diseases of Animals Acts, and the Orders of the Board thereunder, in connection with the carriage of animals by rail, and to their liability thereunder:—

Notice to Owners and Other Persons Concerned with the Consignment of Stock by Rail.

DISEASES OF ANIMALS ACT, 1894.

Provision of Water and Food at Railway Stations.

Section 23.—(1) Every railway company shall make a provision, to the satisfaction of the Board of Agriculture, of water and food, or either of them, at such stations as the Board, by general or specific description, direct, for animals carried, or about to be or having been carried, on the railway of the company.

(2.) The water and food so provided, or either of them, shall be supplied to any such animal by the company carrying it, on the request of the consignor or of any person in charge thereof.

(3) As regards water, if, in the case of any animal, such a request is not made, so that the animal remains without a supply of water for twenty-four consecutive hours, the consignor and the person in charge of the animal shall each be guilty of an offence against this Act; and it shall lie on the person charged to prove such a request and the time within which the animal had a supply of water.

The Board, by the Water Supply on Railways Order of 1895, have required the railway companies to supply water at the principal stations in England, Wales and Scotland.

ANIMALS (TRANSIT AND GENERAL) ORDER OF 1912.

Carriage by Railway of Cows in Calf.

Art 11 —No cow shall be permitted by the owner thereof, or his agent, or any person in charge thereof, to be carried by railway if the calving of the cow during the transit by railway is reasonably probable

Carriage by Railway of Unfit Animals.

Art. 12 —No animal shall be permitted by the owner thereof, or his agent, or any person in charge thereof, to be carried by railway if, owing to infirmity, illness, injury, fatigue, or any other cause, it cannot be carried without unnecessary suffering during the intended transit by railway.

Persons convicted of offences against the Act or Order are liable to fine or imprisonment

In connection with the above the Board particularly desire to impress on owners and consignors of stock the necessity of ascertaining, if they are not already acquainted with the route, how long the journey will last, in ordinary course, and in the interests of the animals care should be taken to avoid loading them in railway trucks earlier than is actually necessary.

MISCELLANEOUS NOTES.

Third Report of the Development Commissioners.

The third report of the Development Commissioners (H.C. 273, price 7½*d.*) contains an account of the proceedings of the Commissioners during the year ended 31st March, 1913. The amount hitherto allocated by Parliament to the Development Fund is £2,900,000, and of this, £726,000 had been allocated in grants or loans by 31st March, 1913. A considerable part of the balance, however, is already appropriated to schemes in process of execution.

Research and Education—A grant of £34,940 was made from the Development Fund to the Board of Agriculture and Fisheries for the purpose of encouraging research by the establishment of research institutes, each carrying forward the investigation of a particular branch of agricultural service, and for assisting the agricultural colleges to demonstrate by experiment the application to local conditions of the results obtained by the research institutes, and to advise farmers within their areas on the more difficult problems of practice.* Further grants amounting to £53,700 have been made to various universities and colleges for buildings, equipment, and farms. A scheme for assisting agricultural instruction of a lower grade is also being put into operation, liberal assistance having been granted to enable local education authorities to provide farms where necessary for purposes of instruction and demonstration at farm institutes.

Growth of New Crops.—A number of tobacco growers in Great Britain have formed themselves, under the auspices of the Development Commissioners, into a co-operative society, not trading for profit, to rehandle and market their tobacco; and a grant of £7,500 has been sanctioned for capital and maintenance expenses during the current year. Arrangements have been completed for an experiment on flax growing to be undertaken by Leeds University. With regard to the beet sugar industry, the Commissioners have provisionally decided that aid might properly be given from the Development Fund on what may be called the educational side of the industry, *i.e.*, providing the farmer with advice and instruction on methods of cultivating, preparing for the factory, and transporting to it the roots which he has grown.

Co-operation.—So far as Great Britain is concerned, the arrangements for assisting the organisation of agricultural co-operation have worked smoothly. The Agricultural Organisation Society of England and Wales has now been re-constituted and the new board of governors have taken up their duties. The Society was allotted a grant up to a maximum of £9,000 for the year (as an interim measure and while it was in a transition state).

Live Stock Improvement.—In addition to the continuance of the grant to the Board of Agriculture and Fisheries for light horse breeding, grants to the amount of £30,000 have been recommended to the Board for the improvement of live stock other than light horses. Particulars of the Board's scheme for the improvement of live stock will be found on p 629. The Commissioners draw particular attention

* A brief statement as to this research and advisory work will be found in Leaflet 197, *Agricultural Education and Research in England and Wales.*

to the advances for the encouragement of milk recording and for the appointment of twelve live stock officers at the agricultural colleges in England and Wales. These officers are intended to give to the farmer, and particularly to the small farmer, the same kind of advice and assistance in regard to his live stock as is given in regard to his crops, fruit, &c., by an advisory officer at a college and by the county staff.

Cattle Testing Station.—A grant of £20,000 was recommended by the Commissioners towards the proposed cattle testing station of the Board. The estimate included £6,000 for the cost of 150 acres of land at Pirbright, Surrey; £7,500 for 150 boxes with yards, &c., and £3,000 for the cost of site and equipment of the laboratory.

Forestry.—A grant of £5,700* was made to the Board in the year ended March 31st, 1913, to enable them to continue the work previously commenced. In addition, grants of £2,500 have been recommended for a new forestry school at Cambridge, £1,000 for a research laboratory at Oxford, and a small grant for a forestry museum and lecture room in Chopwell Woods, administered by Durham University.

The report also deals with the activities of the Commission in regard to many other matters, such as Rural Transport, Harbours, Fisheries, &c.

The Agricultural Estates belonging to the Crown.

The seventh report of the President of the Board of Agriculture and Fisheries as a Commissioner of Woods is contained in the recently issued ninety-first report of the Commissioners of His Majesty's Woods, Forests, and Land Revenues (H.C. 177, 1913, price 1s.).

The principal agricultural estates in England belonging to the Crown and under the charge of the President of the Board of Agriculture and Fisheries at March 31st, 1913, comprised about 72,162 acres, an increase of about 4,874 acres during the year 1912–13. Of the total area of 72,162 acres, 1,695 acres were purchased during the year, and no rents accrued therefrom during the period. The remaining 70,467 acres were divided as follows:—8,773 acres let for small holdings and allotments, 65 farms containing between 50 and 250 acres, 70 between 250 and 500 acres, 22 between 500 and 750 acres, 1 between 750 and 1,000 acres, and 6 farms containing upwards of 1,000 acres, consisting largely of downland; there were also about 762 acres of grass land let annually in lots by auction, and about 5,154 acres of woodland.

The area of land let for small holdings and allotments up to March 31st, 1912, was 7,524 acres, and up to March 31st, 1913, the area was 8,773, thus showing an increase of 1,249 acres during the year. Of this increase, however, about 275 acres of small holdings and allotments were already established on the land acquired in 1912–13. On the land let for small holdings, 8 new cottages and 10 new sets of farm buildings have been, or are being, erected, and 11 cottages are being substantially improved, while a number of homesteads are being altered to fit them for the use of 22 small holders. During the last seven years there have been erected on the 7,524 acres of Crown lands converted into small holdings and allotments 70 cottages and 52 sets

* As regards the part to be spent on technical advice, viz., £2,500, see *Journal* for April, 1912, p. 1, and Jan., 1913, p. 850.

of farm buildings; 30 cottages have been substantially improved, and the homesteads that were on the farms divided into small holdings have been remodelled to fit them for the use of 37 small holders. Arrangements are in hand for letting a further area of land for small holdings and allotments.

The gross income from these estates during the year ended March 31st last amounted to £69,596 and the total expenditure to £27,954, leaving a net income of £41,642 The capital expenditure on new buildings and permanent improvements during the year was £6,797, and on repairs £4,624, while the management expenses amounted to £3,020. Of the expenditure on new buildings, £2,785 was expended in equipping small holdings.

Issue of Certificates required in connection with the Exportation of Plants to Foreign Countries and the Colonies.—With a view to assist nurserymen in England and Wales to develop their export trade, the Board of Agriculture and Fisheries are prepared to issue the Certificates required by the Governments of the countries and colonies to which plants are to be exported, under the following conditions.

Importation Regulations.

1. In cases in which consignments of plants and bulbs are only admitted on production of a Certificate by the Board, or by one of their Inspectors, that the contents have been examined and declared to be healthy or free from certain specified pests, application should be made to the Board a few days before the consignment is to be dispatched. If it is desired that the plants should be sent by parcel post they should be sent ready packed in a box, with the lid not nailed down, to The Secretary, Board of Agriculture and Fisheries, Craven House, Northumberland Avenue, London, W C., marked on the outside "Plants (or bulbs) for export." A prepaid adhesive label addressed to the consignee should be enclosed, and the Customs declaration form required by the Postal Regulations (Post Office Guide, p. 772) should be filled up and affixed to the box. The box will be dispatched by the Board and a receipt of posting obtained.

The necessary sum must also be enclosed if it is desired that the parcel should be insured, but it must be understood that the Board cannot, in any case, accept any responsibility for any loss or damage which may arise during the examination or transit of the goods

No charge will be made for the examination of a consignment which is contained in one box and weighs when packed not more than 11 lb. For the examination of any consignment exceeding that weight, whether packed in two or more boxes, the following charge will be made:—Packages not exceeding 56 lb. in weight, 2*s*. 6*d*. Packages weighing between 56 lb and 1 cwt., 5*s*. Packages weighing over 1 cwt. cannot be examined at the Board's office, and a special fee will be charged for examining them. If the Inspector is required for any reason to travel more than 20 miles to the place where the consignment is to be examined a fee of £2 2*s*. will be charged. The fee must in every case be paid before the Certificate can be issued

2. The Board have made special arrangements to meet the requirements of the Regulations issued by the Government of the United States of America under the Plant Quarantine Act of 1912. These

Regulations require, among other things, that nursery stock shipped between the 1st October and the 31st May shall be inspected on or after the 1st October, and that such stock, if shipped during the growing season, shall be examined at the time of packing. The inspection is required to be carried out under the direction of a duly authorised official of the Board, and the plants must be accompanied by a Certificate of that official as to their freedom from injurious plant diseases and insect pests.

An original Certificate must accompany the invoice of each consignment, and a signed copy must be attached to each "container." Exporters when applying for the Certificate should therefore state how many copies will be required by them.

Growers who propose to export plants to the United States should inform the Board of their intention as early in the year as possible. Preliminary inspections will be made from time to time during the summer months and a final examination will be made as early as possible in October.

Applicants must furnish the Board with a written undertaking that no plants will be shipped under their Certificate except those actually grown on the premises referred to in the Certificate.

After the final examination has been made and if the nursery is found to be free from injurious plant disease and insect pests, the Board will be prepared to issue such Certificates and copies as may be required up to the 31st May in the following year.

The fee charged by the Board for these Certificates will in most cases be £2 2*s.* a year for each nursery, for which sum an unlimited number of Certificates and copies can be obtained In certain cases a larger fee will be charged, while in cases where two or more nurseries in the same occupation can conveniently be examined in conjunction, the Board will be prepared to consider applications for a reduced fee.

In every case the fee must be paid before a Certificate can be issued.

No liability attaches to the Board or to any of their officers in connection with these Certificates.

The Board reserve the right of refusing to consider applications for inspection unless they are received before the 1st November, 1913.

Any stock shipped between the 31st May and the 1st October will be examined under the conditions explained in § 1 of this Memorandum.

N.B.—Nursery stock cannot be admitted into the United States unless a permit for the entry has been obtained from the Department of Agriculture, Washington. Shippers on this side, therefore, would be well advised to see that the necessary permit has been obtained by their customer before the goods are shipped. A declaration by the shipper giving particulars as to the place where the stock was grown, date of inspection, permit number, &c., must be produced before an American Consul and, after signature by him, must accompany the invoice. Entry will not be allowed, moreover, unless the case, box, or other container or covering is plainly and correctly marked to show the number of the permit, the general nature and quantity of the contents, the district or locality and country where grown, the name

and address of the exporter, and the name and address of the consignee.

3. The Board are prepared to issue Phylloxera Certificates, when such certificates are required by the Government of the importing country, in the case of stock exported from nurseries which have been examined by their Inspectors. The fee for such examination will be £2 2*s.* per annum, but a separate fee will not be charged in this connection if the nursery has been inspected in accordance with the arrangement outlined in § 2.

4. In cases in which a Certificate of the Board is required stating that no disease of a certain kind has been reported from the neighbourhood in which the plants were grown a declaration signed (and in some cases sworn) by the grower must be sent, stating that the plants (in most cases potatoes) were grown on a particular farm, and naming the parish and county in which such premises are situate, together with a declaration that the disease in respect of which the Certificate is issued has not occurred on those premises.

The application should be received by the Board *not less than three days before the consignment is to be dispatched.* No charge is made for this Certificate.

In cases in which the Certificates required do not fall within any of the foregoing categories nurserymen who wish to export plants should apply to the Board for further particulars

Importation of Animals into Australia.—The Board of Agriculture and Fisheries have been officially informed that the Government of the Commonwealth of Australia have amended their regulations governing the importation of cattle, sheep, goats, and swine from this country. Animals may now be exported to Australia from all parts of the United Kingdom.

Notes on Agriculture Abroad.

Dutch Cheese Control Regulations.—The Dutch Government have introduced, by two decrees dated July 19th, 1913, regulations for the working of the Control Stations, under State supervision, which deal with cheese manufactured from full-cream milk, and for the stamping of cheeses produced by members of the Stations.

The stamp used for marking the cheese is to consist of a reproduction of the Dutch arms, the word "volvet" (manufactured from full-cream milk) and "45%," which indicates that the dry casein of the cheese contains at least 45 per cent. of fat. The words "Nederlandsche kaascontrole onder Rijkstoezicht" (Control of Dutch cheese under State supervision) are to be placed round the outer edge of the stamp, and a space left which can be utilised for such further letters and figures as may be desirable to facilitate the control.

The stamp will be manufactured by the State at the expense of those interested.

Every cheese produced by the members or dealt with by the Control Stations must bear the stamp, which is to be applied as soon as the cheese is manufactured, and no cheese which is not so stamped must be bought or sold by them. No other stamp may be used by either the members or the Stations.

Cheese Control Stations wishing to be placed under State super-

vision are to admit to membership only those persons or organisations enjoying a good reputation, and they must guarantee that the cheese is produced from full-cream milk without the addition of foreign fats, that the dry casein contains at least 45 per cent. of fat, and that the water-content does not exceed the normal limits.

The members of the Stations must be in no way interested in the manufacture of, or the trade in, margarine, or any other oil or fat which might be used in the adulteration of cheese. They may only keep on their premises such quantities of those materials as are deemed necessary for domestic use. Except for colouring matter, rennet, salt, saltpetre, and spices, no foreign material must be used in the manufacture of the cheese. They are also to allow the officials unrestricted access to their premises.

Sixth International Dairy Congress.—The Sixth International Dairy Congress will be held in Berne on June 8th, 9th, and 10th, 1914. The Congress will be divided into four sections as follows (1) Hygienics; (2) Chemistry and Bacteriology; (3) Theory of Management; (4) Trade. During the Congress excursions will be organised to the most important dairies in the country, and a special feature will be made of viewing breeding farms for Swiss cattle. Papers dealing with subjects contained in the programme should reach the Secretary-General not later than the end of 1913. Applications for membership (which should be accompanied by a fee of 20 francs), or for further particulars, should be addressed to the Secretary-General, Dr. R. Burri, Liebefeld, Berne.

From May to October, 1914, the Swiss National Exhibition will be held in Berne, in which the dairy industry will take a leading part.

Acreage of Hops in 1913.

The Board of Agriculture and Fisheries have issued the following preliminary statement, dated September 30th, compiled from the returns collected on the 4th June, 1913, showing the acreage under hops in each county of England in which hops were grown, with a comparative statement for the years 1912 and 1911:—

Counties, &c.	1913.	1912	1911
	Acres	Acres	Acres
Kent — East	6,103	5,993	5,718
Kent — Mid	7,481	7,330	6,966
Kent — Weald	8,353	8,077	7,507
Total, Kent	21,937	21,400	20,191
Hants	1,556	1,516	1,444
Hereford	5,439	5,236	5,034
Salop	104	103	99
Surrey	557	513	500
Sussex	2,889	2,845	2,698
Worcester	3,151	3,186	3,061
Other Counties	30 *	30	29
Total	35,663	34,829	33,056

* Gloucester and Stafford

The Weather in England during September.

District	Temperature. Daily Mean	Temperature. Diff from Average.	Rainfall Amount	Rainfall Diff from Average.	Rainfall Number of Days with Rain.	Bright Sunshine. Daily Mean	Bright Sunshine. Diff. from Average
Week ending Sept. 6th	°F.	°F	Inches.	Inches		Hours	Hours.
England, N E	56 6	+0 7	0 34	−0 26	4	1 8	−3·1
England, E	59·5	+1 8	0 67	+0 19	5	1·0	−4·4
Midland Counties	57·9	+1 4	0·90	+0 39	4	1·3	−3 5
England, S E	60 1	+1 3	2 05	+1 48	5	0 6	−4 9
England, N W. ...	57 7	+1 4	0 00	−0 70	0	3 8	−0 8
England, S W	58 9	+1 4	1 64	+0 93	4	1 5	−3·7
English Channel	62 2	+2 1	0 23	−0·33	2	3 3	−3·1
Week ending Sept 13th							
England, N E . .	55 8	+0 9	0 28	−0 18	3	6·0	+1·2
England, E . .	57 3	+0 5	0 06	−0 33	1	6 3	+1 1
Midland Counties ..	56 4	+0 7	0 27	−0 13	2	5 1	+0 4
England, S E	58 6	+0 6	0 18	−0 26	2	7 0	+1 6
England, N W.	55 6	−0 1	1 14	+0 57	4	4 7	+0 1
England, S.W	57 6	+0·7	0 80	+0 23	3	5 1	0 0
English Channel	59 9	+0 3	0 84	+0 36	3	6 6	+0 1
Week ending Sept 20th							
England, N E	54 9	+1 0	0 92	+0 57	4	4 6	+0·3
England, E	56 4	+0 8	1 05	+0 63	5	4 9	0 0
Midland Counties	54·0	−0·4	0 66	+0 22	4	3 9	−0 4
England, S E .	55 3	−1 5	0 81	+0 34	5	4 9	−0 1
England, N W ...	54 1	−0 5	0 22	−0 44	3	4 7	+0 6
England, S W	54 2	−1·7	0·70	+0·01	4	4 9	+0 2
English Channel	57 1	−1 7	0 62	+0·04	5	7 0	+0 9
Week ending Sept 27th							
England, N.E.	58 4	+6 1	0 69	+0 29	4	3·1	−0 9
England, E.	59 7	+6·1	0 12	−0 41	2	4 6	+0 2
Midland Counties	59 6	+7·2	0 45	−0 09	3	3 5	−0 4
England, S E ...	60 1	+5 1	0 18	−0·44	1	5 0	+0 5
England, N.W	59 4	+6 5	1·22	+0 40	4	1·9	−1 8
England, S.W	59 5	+5 2	0·43	−0 46	3	2 4	−1 8
English Channel	61 6	+4·1	0 24	−0 53	2	5·0	−0 1

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for September, issued by the International Agricultural Institute, gives estimates of the production of cereal crops in certain countries. The total production of wheat in Prussia, Belgium, Bulgaria, Denmark, Spain, France, England and Wales, Hungary, Italy, Luxemburg, Rumania, Russia (73 Governments), Switzerland, Canada, United States, India, Japan, Algeria (excluding the Department of Algiers), and Tunis, is estimated at 416,156,000 qr., an increase of 4·1 per cent. compared with last year. For the same countries, except France and India, the production of barley is estimated at 146,933,000 qr., an increase of 1·2 per cent., and that of oats at 351,380,000 qr., or a decrease of 5·9 per cent. compared with 1912. Excluding

England and Wales, India, Japan, Algeria, and Tunis, the production of rye in the remaining countries is given as 174,575,000 qr., or a decrease of 6·7 per cent. The production of maize in Bulgaria, Spain, Hungary (proper), Italy, Russia in Europe (63 Governments), Switzerland, United States, Japan, and Tunis, is estimated at 322,702,000 qr., or a decrease of 22·4 per cent. on 1912.

The *Bulletin* also states that preparatory work for spring sowing in *Chili* is being carried out under good conditions; sowing has commenced, and is taking place satisfactorily. In *New Zealand* the condition of the winter wheat, barley, and oat crops is average. Preparatory work for spring sowing, and sowing itself, is taking place under bad conditions, the weather being damp, cold, and stormy. In the United States there is a decrease of 37,439,000 qr. on last month's estimate of the maize crop, representing a decrease of 24·8 per cent. on last year's crop. The cool, rainy weather in *Italy* has everywhere benefited the crop, and the condition was good on September 1st. The area under maize in Rumania is about 5,303,000 acres, against 5,135,673 acres cropped in 1912, and the condition of the crop on September 1st, according to the Institute's system, was 120, against 125 last year. The condition of the crop in Canada on September 1st, expressed according to the Institute's system, was 99, against 84 at the same date last year. In *Lower Egypt* the maize crop is about twenty days late. In *Upper Egypt* the crop is still later, and was sown over large areas without previous ploughing, due to water being scarce and late. *Australia.*—The area sown with wheat in 1912–13 amounts to 7,336,132 acres, against 7,424,561 acres in 1911–12. Definite figures for the harvest of 1912–13, compared with those for the preceding year, are as follows:—Wheat, 11,493,000 qr., as compared with 8,952,000 qr in 1911–12; barley, 488,000 qr., against 257,000 qr.; oats, 2,065,000 qr, against 1,195,000 qr.; and maize, 945,000 qr., against 1,054,000 qr.

Sugar Beet.—The production in Hungary (proper) is estimated at 4,659,399 tons, a decrease of 1·3 per cent. compared with last year; and in Denmark at 972,909 tons, an increase of 23·1 per cent. The condition of the crop in Austria and Italy is good, and in Belgium the growth of the plants has been favoured by the weather.

France.—The Ministry of Agriculture estimated the production of wheat at 38,954,000 qr, compared with 40,736,000 qr in 1912; of rye at 6,381,000 qr., compared with 5,922,000 qr.; of barley at 5,859,000 qr., compared with 5,945,000 qr.; and of oats at 39,022,000 qr., compared with 37,995,000 qr. Harvesting was carried out under excellent conditions, and the quality of the grain is excellent. Straw is excellent as regards both quantity and quality. (*Journal Officiel,* France, Sept. 17th and 24th.)

Holland.—The official report relating to conditions on September 18th states that wheat was harvested under good conditions, and the yield may be regarded as good except in Groningen, where it is average. Only in Zeeland is the oat crop reported to be less than was expected. Elsewhere it is good or very good. Some crops of potatoes are looking well, but others will be below average. A moderate crop of sugar beet with a satisfactory percentage of sugar

is expected. Onions look fairly well everywhere, although the bulbs are generally small; so far, trade in this commodity has been depressed. (*H.M. Consul at Rotterdam,* Sept. 27th.)

Germany.—The official report referring to the beginning of October states that potato-lifting was in full swing, and in some parts finished. The yield is generally quite satisfactory as regards both quantity and quality. On wet and heavy soils, however, and especially as regards the earlier varieties, the crop leaves much to be desired, disease being prevalent. The condition is now placed at 2 4, compared with 2 6 last month (2=good, 3=average). (*Deutscher Reichsanzeiger,* October 7th.)

Prussia.—The *Statistische Korrespondenz* of September 10th gives the following estimates of production, to which are added, in brackets, the 1912 figures:—Winter wheat, 10,746,000 qr. (11,240,000 qr.); spring wheat, 1,542,000 qr. (1,380,000 qr.); winter rye, 42,509,000 qr. (40,014,000 qr); spring rye, 371,000 qr. (284,000 qr); spring barley, 10,578,000 qr (10,867,000 qr.); oats, 44,038,000 qr (41,191,000 qr.); and potatoes, 34,683,000 tons (34,340,000 tons) A later report gives the yield of potatoes in Prussia as 37,993,000 tons. (*Dornbusch,* October 9th, 1913.)

Hungary.—The official report gives the following estimates of production (in quarters, and the final estimate of 1912 in brackets).—Wheat, 18,717,000 (21,660,000), rye and meslin, 6,095,000 (6,315,000; barley, 9,099,000 (8,414,000); oats, 9,909,000 (7,872,000); maize, 21,549,000 (20,609,000); potatoes, 4,696,000 tons (5,296,000); and sugar-beet, 4,659,000 tons (4,719,000). In some mountainous districts, where ripening was delayed, corn was still out, but elsewhere threshing was in full swing, and ploughing and sowing of winter cereals in progress. The quality of the grain is generally very satisfactory, although in some districts, owing to heavy rains, sprouting had occurred

Italy.—The final official estimates of the production of cereals are as follows (in quarters, and 1912 figures in brackets) —Wheat, 26,842,000 (20,425,000); rye, 653,000 (618,000); barley, 1,294,000 (1,025,000); oats, 4,579,000 (3,028,000); and the preliminary estimate of maize, 12,018,000 (11,546,000) (*Dornbusch,* October 3rd.)

Canada.—A bulletin issued by the Census and Statistics Office at Ottawa, relating to conditions at the end of August, gives the following estimates of the yield of the cereals (in bushels):—Spring wheat, 192,517,000; winter wheat, 18,481,000; total, 210,998,000, compared with 199,236,000, the final estimate of 1912; oats, 395,341,000, compared with 361,733,000; barley, 44,440,000, compared with 44,014,000; and rye, 2,425,000, compared with 2,594,000. Weather conditions were favourable for harvesting. In Ontario the grain was nearly all harvested by the end of August, while in the prairie provinces operations were about two-thirds completed, and it was expected that threshing would be general by September 10th. In the Maritime Provinces the harvest was more backward and was not expected to be general until about the end of September.

United States.—The Department of Agriculture gives the following estimates of the production of the principal crops, as indicated by their condition on October 1st (in bushels, and 1912 figures in brackets) — Winter wheat, 511,000,000 (399,919,000); spring wheat, 242,714,000 (330,348,000); oats, 1,122,139,000 (1,418,337,000); barley, 173,301,000

(223,824,000); maize 2,373,000,000 (3,124,746,000); and potatoes, 319,000,000 (420,647,000). The average quality of spring wheat is 92 per cent, compared with 88·7 per cent. last year. (*Dornbusch,* October 9th.)

Argentina.—The Ministry of Agriculture estimate the 1913-14 area under wheat at 16,364,000 acres, compared with 16,964,000 acres in 1912-13, and under oats at 3,089,000 acres, compared with 2,939,000 acres. (*Dornbusch,* October 6th.)

Fruit.—*United States.*—H.M. Consul at Portland, Oregon, reported on August 23rd that the prune crop of Oregon was estimated at 30,000,000 lb., compared with 25,000,000 lb. last year, while the Californian crop, which had previously been estimated at 175,000,000 lb., was not expected to exceed 125,000,000 lb.

Holland.—An official report giving the condition of fruit on September 15th stated that complaints were heard in various parts of the country, especially in Guelderland, of scab on apples and pears, and much fruit was either worm-eaten or had fallen too early. Prospects generally were only fair (*H.M. Consul at Amsterdam,* September 22nd)

Hops.—The following particulars have been extracted from special reports received from H M. Consuls abroad:—*Germany.*—Early hops did not weigh as well as was expected, although the quality was satisfactory. A surplus for export was, nevertheless, anticipated In Wurtemberg the crop had been materially over-estimated, and was not expected to exceed 27,500 cwt. (47,200 cwt. in 1912). *Belgium*—When picking was in progress it was found that previous estimates would have to be reduced by about 10 per cent., which would indicate a total production of some 50,000 cwt. *Russia.*—Picking was general about the middle of September The total production was expected to be less than last year, and was estimated at about 50,000 cwt. *United States.*—The area under hops in the State of New York was about 10,000 acres, and with continued fine weather the yield was estimated at about 60,000 cwt., or rather more than in 1912. A very high percentage would be of excellent quality. *Austria.*—The official report relating to the middle of September stated that the crop in the Saaz district of Bohemia, picking being practically over, had turned out to be less than was expected, and some areas had not been picked at all. In the Auscha district the yield was described as a poor average, and the same was said of Upper Austria and Styria The quality was generally considered very good, and the hops, although small, were rich in lupulin.

Live Stock in Canada.—The estimates of the number of livestock in Canada on June 30th, published in the August *Journal,* have been revised, and the figures are now given as follows:—Horses, 2,535,800, an increase of 6 6 per cent., compared with 1912; milk cows, 2,648,800, an increase of 5 2 per cent.; other cattle, 4,183,000, an increase of 2 5 per cent.; sheep, 2,141,000, an increase of 2·7 per cent.; and pigs, 3,071,600, a decrease of 2 6 per cent. (*Bulletin of Agricultural Statistics,* September.)

Agricultural Conditions in England and Wales on October 1st.

The reports furnished by the Crop Reporters of the Board on agricultural conditions in England and Wales refer to the beneficial effects generally upon the crops of the varied weather of September, with the single exception that it had proved a hindrance in the case of such corn as had not been harvested by the end of the month. In the hilly districts a certain proportion still remained out, and in a few such cases the quality was thought to be affected by the wet.

Potato lifting had generally commenced, and in some districts was well advanced. The tubers are sound, and there is very little mention of disease, except in the south-east, and one or two other districts. The potato crop has greatly benefited from the rains during the month. In Lincoln it is expected to give nearly an average yield, and not much below in Lancashire. Throughout the country the yield will probably prove to be about 97 per cent. of the average.

Roots have made good growth during the month, and prospects show an improvement over September 1st. But the previous droughty weather had left the crops thin and irregular, with numerous failures, so that the damage can only be partially repaired. The moister north and west have much better crops than the east and south; indeed, North Wales expects a fully average yield of turnips and swedes. Mangolds will probably yield better than turnips in the country as a whole. Prospects now are that turnips and swedes will yield 83 per cent. and mangolds 89 per cent. of the ten years' average

Seeds, like roots, suffered from the prolonged dry weather, and, as in their case, the rain, which has enabled them to grow well, came too late to make them at all promising in the east and south of England. In the west and north they are often reported as vigorous and healthy, although there are even there many exceptions On the whole, they cannot be considered satisfactory.

Autumn cultivation is generally well forward, although the progress made in different districts varies. A certain amount of winter wheat has been sown.

Pastures have mostly made good growth during September, and the rains have restored them to good condition. Live stock are consequently making more satisfactory progress.

Labour is reported to have been, on the whole, sufficient, but from all parts there are some complaints, particularly as regards the more skilled hands. The favourable weather has been an important factor in enabling most classes of work to be performed relatively quickly.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on October 1st, 1913, certain diseases of animals existed in the countries specified:—

Austria (for the period September 18th—24th)

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 991 Hofe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period September 1st—15th).
Anthrax, Blackleg, Foot-and-Mouth Disease (170 outbreaks in 48 communes), Rabies.

Bulgaria (for the period August 21st—29th).
Sheep-pox.

Denmark (month of August).
Anthrax, Foot-rot, Glanders and Farcy, Swine Erysipelas, Swine Fever.

France (for the period September 14th—20th).
Anthrax, Blackleg, Foot-and-Mouth Disease (3,460 outbreaks), Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period September 1st—15th).
Foot-and-Mouth Disease (14 infected places in 10 parishes), Glanders and Farcy, Swine Fever.

Holland (month of August).
Anthrax, Foot-rot. Swine Erysipelas

Hungary (for the period September 4th—10th).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 736 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period August 18th—24th).
Anthrax, Blackleg, Foot-and-Mouth Disease (3,221 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever

Montenegro (no further returns received)

Norway (month of August).
Anthrax, Blackleg, Swine Fever.

Rumania (for the period September 5th—13th)
Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (month of May).
Anthrax, Foot-and-Mouth Disease (9,042 animals in 130 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (no further returns received).

Spain (month of June).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (6,368 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of August).
Anthrax, Blackleg, Swine Fever.

Switzerland (for the period September 15th—21st).
Anthrax, Blackleg, Foot-and-Mouth Disease (1,030 "étables" and Alpine-Pâturages entailing 21,947 animals, of which 214 "étables" and Alpine-Pâturages were declared infected during the period), Swine Fever.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in September:—

Agricultural Labour in England during September.

Labourers outside the regular farm staff found a fair amount of employment at agricultural work in most districts during September. There was, on the whole, but little loss of time through bad weather. A short corn harvest, however, reduced the demand for such extra men in many districts. On the other hand, the improvement which had taken place in the root crops in certain districts was a means of increasing the amount of employment offered. In addition to harvesting corn and hoeing root crops, extra men were employed at such work as threshing, trimming hedges, lifting potatoes, carting manure, and cleaning stubble land

The supply of extra men was, on the whole, about equal to the demand, with a tendency to be below requirements in certain cases Some scarcity of men for permanent situations was reported from *Kent, Wiltshire,* and *Somerset.*

THE CORN MARKETS IN SEPTEMBER.

C KAINS-JACKSON.

British Wheat.—The deliveries of September, 1912, were so exceptionally small that those of the past month have seemed heavy by comparison. In comparison with earlier deliveries, they were not exceptional. The new wheat thus far brought to market exceeds that of 1912 in weight generally, in quality very often, and in condition almost invariably. The wheat gradient for September was less than usual, a market average above 34*s.* being very rare, and scarcely any leading exchanges falling below the thirty-shilling level Millers have come forward freely, but farmers have not been ready sellers at anything under 37*s.* for 504 lb. for white, 35*s.* 6*d.* for good heavy red, 34*s.* for 480 lb white, 33*s.* for 480 lb. red, and 30*s.* per 448 lb. for poultry wheat. The bulk of this year's crop has been secured in excellent order, and the proportion of chicken corn is much lower than a year ago. Newly-made stacks were not blown about and more or less unthatched as they so often are Altogether farmers at the September markets have been in good heart over their new wheat. At the end of the month there were buyers of seed corn. The warm fortnight at the end of September, coming, as it did, after a fair rainfall, created an excellent seed-bed. Burgoyne's Fife, Squarehead's Master, and the various Stand-Ups are already in very fair sowing request. The demand for French types of wheat is hardly so good as it was a few years ago.

Colonial and Indian Wheat.—As September progressed, holders of 1912 Canadian showed a decided disposition to take less money in order to effect sales. About a shilling concession has been made, or 2*s.* since August 1st. The quality of the old wheat cannot be said to have come up to what millers expect, but the new wheat is exceedingly well spoken of, and, the frosts in Canada being stated to have

set in later than usual, the percentage of wheat reduced below milling grade is likely to be the smallest for some seasons. The forward or speculative prices for new crop Canadian favour the British miller, and a large business is anticipated. The Indian wheat market shows little change; one may quote best white Calcutta at 38*s*., No. 2 at 37*s*. 9*d*., Soft Red at 37*s*., best white Delhi at 38*s*. 6*d*., Soft Red Bombay at 38*s*., White Karachi at 37*s*. 9*d*., and Red Karachi at 37*s*. 6*d*. The red sorts now come up closer in selling value to the whites than they used to do. The weight of the Indian produce is good—492 to 496 lb Australian wheat is sometimes a minor article in the last few months of the year, but is now represented by 385,000 quarters on passage Weight does not exceed 480 lb., but colour is fine, and 38*s* is a price on which both buyers and sellers seem fairly agreed

Foreign Wheat.—New York quotes Red Winter Wheat 2*s*. 6*d*. per qr. lower than a year ago, and has been a free seller for exportation. Russia has shown a disposition to take rather low prices for new wheat, and if the buyer could feel sure of deliveries being in a clean state there might very possibly be a brisk business. As it is, only a hundred thousand quarters of Russian wheat are at present on passage to this country. South-eastern Europe is now recovering ground as a shipper, but has not yet consigned any new wheat to Great Britain. Argentine wheat arrivals have been moderate, and prices are fairly well maintained It is not thought likely that there will be much done in South American until the new crop begins to reach us towards the close of January.

Supplies and Shipments.—Imports were by no means excessive, and before the month closed the supply on passage had fallen to 1,700,000 qrs., which is decidedly below the average The shipping countries sent off the following quantities in the course of the month — North America, 2,195,000 qrs ; South America, 64,000 qrs , Russia, 1,792,000 qrs ; Europe, S E , 325,000 qrs.; India, 587,000 qrs ; and Australia, 146,000 qrs Continental buying was always fair during September, and at some periods brisk

Flour—There was an unusually successful Bakers' Exhibition at Islington, and the business done by millers was understood to have been above the average At 27*s* cash large quantities of London Household Flour are believed to have been placed on the sound basis of weekly deliveries from Michaelmas to Christmas Town Whites now come at a cash price of 30*s* , and No 2 Household at 25*s*. 6*d*. to 25*s*. 9*d*. Country flour has been a little dear in proportion both to London makes and to American and Canadian offers; 26*s*. 6*d*. for patents and 24*s*. 6*d* for roller whites are the ruling cash terms Imported flour has a very wide range, from 24*s* for American winter wheat flour second grade, to 38*s*. for fine Hungarian. Sorts in request have included Canadian First Bakers' at 25*s*., Minnesota Seconds at 25*s*. 6*d*. to 25*s*. 9*d*., Duluth at 27*s*. to 27*s*. 6*d*., and Pillsbury's Best at 28*s*. to 28*s*. 3*d*. A fair trade has been done in Whole Meal at 26*s* 6*d*. to 27*s*. per sack, and a notable feature of the Islington Show was the large and varied supply of bread, depending on one or other of the rougher grists, sometimes united with a malt extract. North America in September shipped 576,000 sacks of flour, and there are 230,000 sacks on passage.

Barley.—The buying season for malting has not begun early this year, but a good trade has been done in winter barley and in bold samples for poultry food. Imported feeding barley has been a brisk trade at a marked decline, the prodigious shipment of 3,780,000 qrs. from Russia compelling the prompt and frank acceptance of a low price, say 21*s.* 6*d.* per qr. Indian Barley has made 25*s.* to 27*s.*, New Tunisian 32*s.* to 34*s.*, and Anatolian 32*s.* to 40*s.* The two last-named sorts are of use to the brewer. California brewing barley is quoted at 35*s.* to 38*s.* per 448 lb., and there are 150,000 qrs. on passage. Of feeding barley 330,000 qrs. are coming from Russia, 150,000 qrs. from India, and 15,000 qrs. from Persia. September shipments other than the Russian were moderate, totals being:—California, 123,000 qrs.; India, 121,000 qrs.; and Europe, S.E., 180,000 qrs.

Oats.—The prices accepted for English oats have been rather low, and foreign sorts have been in very poor request. The warm weather at the close of the month caused the markets to be depressed, several English markets quoting prices below 18*s.*, and a few going below 17*s.* The price of Argentine was 16*s.* 9*d.* to 17*s.* for Bahia Blanca and 16*s.* to 16*s.* 3*d.* for Buenos Aires. Russia at Michaelmas was offering to ship Petersburg 38-lb. oats at 16*s.* 3*d.*, Black Libau at 17*s.* 6*d.*, and 40-lb. Vologda at 18*s.* 6*d.*, the last-named being good value at the price. September shipments were 438,000 qrs from Russia, 80,000 qrs. from North America, and 59,000 qrs. from South America. These quantities were much under an average exportation, and the total on passage had by the 30th fallen to 120,000 qrs. The sale of winter oats for seed purposes has been rather good

Maize—Shipments from Argentina for September reached the high total of 2,422,000 qrs., but as compared with 3,900,000 qrs shipped in August, holders in this country have felt the figures as a relief Other exporters were Russia, 214,000 qr; and S E Europe, 51,000 qr, North America being a non-shipper. Imports of maize for September are about 1¼ million quarters, or 25 per cent. above a very liberal reckoning of our average requirements. There were 1,600,000 qrs on passage on August 31st; on September 30th the total still stood as high as 1,520,000 qrs. Prices in the last few days of September fell fully 1*s.* per qr., the exceptional heat seeming to reduce demand very heavily, weak holders being much affected. Yet maize for winter delivery was being held with the fullest confidence, and prices for January were fourpence per cental above those for October The next twelvemonth is expected to feel a scarcity of flat maize, but there seem hopes of an average offering of round corn. The yellow maize of La Plata is at present in the ascendant, but Burma is making offers to ship at £6 6*s.* per ton, and buying would take place at £6.

Oilseeds.—Very free shipments from North America made linseed a rather difficult market during September, the more so as the Canadian crop reports were more favourable and a good export surplus was expected. As, however, the United States are expected, with their really short yield, to buy of Canada, the quantity of Canadian linseed reaching us between now and next October may not be large. Shipments for September were 205,000 qrs. from North America, 215,000 qrs. from South America, and 301,000 qrs. from India. At the close of the month cargoes of linseed commanded 46*s.* 6*d.* for

Indian, 44*s.* for Argentine, and 44*s.* 6*d.* for North American, while the usual market price to what may be called small wholesale buyers was about 48*s.* for any of the three types. This price also commanded New Zealand, a somewhat infrequent consignment. Fine Morocco and Russian made 52*s.* to 54*s.*, and English 54*s.* to 56*s.* per qr. As the month wore on and the new Egyptian crop began to come down to the coast, cottonseed proved impossible to maintain at the exceptional price of 10*s.* per cwt.; by the 30th, 9*s.* was accepted. There are 370,000 qrs. of linseed and 31,000 tons of cottonseed on passage.

Various.—New beans and peas are rather good samples as a rule; new maple peas fetch 35*s.* to 38*s.*, new dun peas 34*s* to 36*s* ; new winter beans 33*s* to 34*s.*, and new Soya beans 36*s.* to 38*s.* per qr. A good supply of winter tares has caused the price to fall to 48*s.* for fine 532-lb. samples and 40*s.* for common. At these quotations the buyer should do well. There is an increased demand for mustard-seed, 88*s.* per qr. being paid for fine samples, and 72*s.* to 80*s.* for lots which are of a commoner description. During the month beet sugar has remained very cheap—under 10*s.* per cwt.

THE LIVE AND DEAD MEAT TRADE IN SEPTEMBER.

A. T. MATTHEWS.

Fat Cattle.—The timely rains which began in the last week of August and recurred at intervals during September put an end to the anxiety of graziers as to the autumn keeping, and at once checked the downward tendency in the value of cattle. There was the usual falling-off in the condition of the animals, and well-finished bullocks have become scarcer each week, till, at the close of the month, quotations for first quality Shorthorns varied very widely at different markets. For instance, stall-fed bullocks at Ipswich realised 9*s.* 6*d.* per stone, while the best of the breed at Salford only fetched 8*s.* 2*d.*, this comparatively low price of the grass-fed cattle denoting that they were weighing badly.

The Herefords appear to have withstood the effects of the drought exceptionally well, and are the only breed that increased their average during the past month. In the English and Welsh markets held in September, first quality Shorthorns averaged 8*s* 8*d.* per stone, and 7*s.* 11*d.* for the second quality, against 8*s.* 9*d.* and 8*s.* in August; Herefords averaged 9*s.* 2*d.* and 8*s.* 5*d.*, against 9*s.* and 8*s.* 4*d.*; Devons, 9*s.* and 8*s.* 2*d.*, against 9*s.* and 8*s.* 3*d.*; Welsh, 8*s.* 6*d.* and 7*s.* 11*d.*, against 8*s.* 8*d.* and 8*s.* 1*d.*; and Polled Scots, 8*s.* 9*d.* and 8*s.* 7*d.*, against 9*s.* and 8*s.* 7*d.* per stone.

The chief features at the Metropolitan Market during the month were the good shows of Herefords, both for numbers and condition; the considerable supplies from Ireland; the absence of Aberdeens from Scotland; and the short numbers of Welsh Runts. A few choice Devons were occasionally on offer, and sold well.

Veal Calves.—The trade for fat calves was very steady, and there

was no change in their average values as compared with August. In about twenty leading markets they averaged 9*d.* and 8*d.* per lb. for first and second quality, these prices being about $\frac{1}{2}$*d.* per lb. higher than those ruling last year at the corresponding date.

Fat Sheep.—The favourable change in the weather, as affecting the prospects for autumn and winter keep, had the salutary effect of preventing the premature marketing of sheep in only middling condition, and markets at once assumed a better tone. Average prices for Downs and Longwools advanced $\frac{1}{4}$*d.* per lb. in the second week, and the improvement was more than maintained to the end. In over twenty leading English markets Downs averaged 8$\frac{3}{4}$*d.*, 8*d*, and 6$\frac{1}{2}$d. per lb, for the three qualities, against 8$\frac{1}{2}$*d.*, 7$\frac{3}{4}$*d.*, and 6$\frac{1}{4}$*d.* in August; Longwools averaged 8$\frac{1}{4}$*d.*, 7$\frac{1}{4}$*d*, and 6*d.*, against 8*d.*, 7*d.*, and 5$\frac{3}{4}$*d.*; Cheviots again averaged 9*d*, and prime Cross-breds 8$\frac{3}{4}$*d*, against 8$\frac{1}{2}$*d.*

It may have been observed that Longwools at Islington are often quoted lower than at many country markets. This is owing to the fact that the breeds so described which are supplied to that market are usually those of heavy weight, such as Romney Marsh wethers and Irish Roscommons The latter were forward in considerable numbers during September.

Fat Lambs.—The heavier lambs have been making no more per lb. than small sheep, but the trade has been very firm, with a fair demand for the smaller sizes The averages for the month have been 9$\frac{1}{4}$*d.* and 8$\frac{1}{2}$*d.* per lb, against 9$\frac{1}{4}$*d* and 8$\frac{1}{4}$*d.* in August.

Fat Pigs—The averages for bacon pigs are slightly lower than in August, but the trade has continued good. The averages in about twenty-five English and Welsh markets were 8*s.* 7*d.* and 8*s* 1*d.* per 14-lb. stone, showing a decline of 2*d.* and 3*d.* respectively on the month

Carcass Beef—British.—There was much complaint amongst sellers in the London dead-meat markets of the slackness of the demand for beef. Supplies, however, were by no means heavy, and were disposed of, if with some difficulty, at very similar prices to those of August Scotch short sides averaged 4*s.* 10*d* and 4*s.* 7*d.* per 8-lb. stone, against 4*s.* 10*d.* and 4*s.* 8*d.*, 5*s.* being rarely reached. Long sides averaged 4*s.* 6*d* and 4*s.* 4*d*, showing no change; English, 4*s.* 3*d* and 4*s.* 1*d*, against 4*s.* 4*d.* and 4*s.* 2*d.*; and Irish, 4*s.* 1*d.* and 3*s* 10*d.*, against 4*s.* 2*d* and 4*s* 1*d.* per stone. The Irish sides were of moderate quality.

Canadian Beef.—The supplies were irregular and never very considerable in September, and average prices were 4*s.* 2*d.* and 4*s* per stone, against 4*s.* 3*d.* and 4*s* in August.

Chilled Beef.—As frequently happens, there was more fluctuation in the price of Argentine chilled beef than in any other description. Hindquarters were dearest in the third week, when they were fetching 3*s.* 8*d.* per stone The average for hinds was 3*s* 6*d* and 3*s.* 2*d.* for first and second quality, exactly the same as in August. Forequarters sold relatively better, and averaged 2*s.* 3*d.* and 2*s.*, against 2*s.* 1*d.* and 1*s.* 11*d.* per stone in August.

Frozen Beef.—The value of frozen beef has remained steady at

practically the same level as that of August. New Zealand hinds again averaged 2*s.* 9*d.* and 2*s.* 7*d.*, and fores 2*s.* and 1*s.* 10*d.* per stone.

Carcass Mutton—Fresh Killed.—A dull, quiet business has been passing in fresh-killed mutton, this being partly attributable to the coming of the pork season Scotch has just maintained the August average of 5*s.* and 4*s.* 8*d.* per stone, but quotations for English average 2*d.* per stone advance for best quality. The latter comes out at 4*s.* 4*d.* to 4*s.* 8*d.* per stone. Dutch "sheep" average 4*s.* 5*d*, and "tegs" 5*s.* and 4*s.* 8*d.*, the latter being really lambs of this year now sold as mutton.

Frozen Mutton.—New Zealand mutton has shown some improvement, and is now spoken of as selling dear at an average of 3*s.* 1*d.* and 2*s* 8*d.* for first and second quality, or 2*d* per stone higher than last month. Argentine and Australian fetch about 2*d.* per stone less than New Zealand

Lamb—Fresh-Killed.—English lamb has sold at exactly the same price as Scotch mutton, averaging 5*s.* and 4*s.* 8*d.* per stone, according to quality.

Frozen Lamb—New Zealand lamb has been in steady request, and has fetched a little above the August prices, averaging 4*s.* and 3*s.* 8*d.* per 8 lb. There has been no other frozen lamb properly so described.

Veal—British veal of really choice quality has been offered in very small quantity, and has made as much as 5*s.* 8*d.* per stone, averaging 5s 6*d.* for first and 4*s.* 10*d* for second quality.

Pork—Supplies of pork have been seasonably larger, but have been easily cleared at 4*s.* 10*d.* to 5*s* 2*d.* per stone, according to size, Dutch fetching 2*d* to 4*d* per stone less money.

THE PROVISION TRADE IN SEPTEMBER.

HEDLEY STEVENS.

Bacon—During nearly the whole of the month prices of most cuts of bacon have been very firm, and on the whole against buyers, especially for the now popular cut of long sides. These conditions have been brought about by the comparatively small arrivals of all hog products, and the prolonged demand from holiday resorts, owing to the warm and fine weather during September.

The demand for Danish and Dutch sides has been exceptionally good, especially from the North of England, causing the London market to maintain present high prices, especially during the latter part of the month With the continued small arrivals of American and Canadian bacon, Russian and Polish long sides experienced a very good demand at hardening prices, selling in some cases several days before arrival

Advices from America report a good consumptive demand, available stocks clearing at high prices, while receipts of hogs have increased at the chief packing centres. There is too large a demand to permit a break in figures demanded by hog buyers, especially in face of the

poor maize crop, and consequent reported general marketing of the younger animals.

At Chicago during the month prices for hogs have ranged from $8.00 to $9.25, against $7 60 to $9.20 last year, and $6.10 to $7.50 two years ago.

Home products are also firmer in sympathy with imported bacon, and the shortage of pigs continues, with high prices prevailing in all districts.

Cheese.—At the commencement of the month prices were generally firmer, especially for Canadian, but by the end of the month, with easier quotations cabled from Canada, a reaction set in, and although official quotations showed little change, sellers were easier to approach.

The shortage of this season's make in Canada gets more apparent, as up to September 18th the arrivals in Montreal were 144,042 cheese short of last year, when the total receipts were 1,313,293 cheese. The total shipments from Montreal from May 1st to the middle of September were 1,023,738 cheese, against 1,163,476 for the same period in 1912, and 1,268,504 in 1911.

Estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 298,000, against 317,000 at the same time last year, and 269,000 two years ago.

Estimated stocks of New Zealand cheese in London and Bristol were 300 crates (two cheese in each), against 550 last year, and 250 two years ago

There is a very good demand for English cheese at hardening prices, and many dealers confine their attention to this description, as they are better value, in comparison with imported lots, at the present high range of prices.

Butter —There has been a good steady trade in butter throughout the month, and all choicest lots quickly cleared at advancing prices.

Arrivals of foreign butters have steadily declined since early in August Colonial arrivals have also declined during the same period, causing an advance in prices. This advance has caused a better demand for secondary butter, but prices do not show a proportionate advance, as stocks of this description are still large. In Canada the make of butter continues good, and up to the middle of September the receipts in Montreal were 24,900 packages more than for the corresponding period of last year

There has been a good trade in Irish at advancing prices.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in September and August, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	September		August	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone *	per stone *	per stone *	per stone. *
Cattle:—	s. d.	s. d.	s d	s d.
Polled Scots	8 9	8 7	9 0	8 7
Herefords	9 2	8 5	9 0	8 4
Shorthorns	8 8	7 11	8 9	8 0
Devons	9 0	8 2	9 0	8 3
Welsh Runts	8 6	7 11	8 8	8 1
	per lb.*	per lb *	per lb *	per lb.*
	d.	d.	d.	d
Veal Calves	9	8	9	8
Sheep:—				
Downs	8¾	8	8½	7¾
Longwools	8¼	7½	8	7
Cheviots	9	8¼	9	8¼
Blackfaced	8¼	7¾	8	7¾
Welsh	8	7¼	8	7½
Cross-breds	8¾	7¾	8½	7¾
	per stone *	per stone *	per stone *	per stone.*
Pigs:—	s. d.	s. d.	s d	s d
Bacon Pigs	8 7	8 1	8 9	8 4
Porkers	9 0	8 6	9 0	8 6
LEAN STOCK:—	per head	per head	per head.	per head
Milking Cows —	£ s.	£ s.	£ s	£ s
Shorthorns—In Milk	24 0	19 16	23 10	19 8
,, —Calvers	22 16	19 8	21 17	18 13
Other Breeds—In Milk	20 12	18 2	20 14	17 7
,, —Calvers	15 10	14 17	15 17	14 6
Calves for Rearing	2 10	1 18	2 11	1 19
Store Cattle:—				
Shorthorns—Yearlings	10 10	9 3	9 18	9 6
,, —Two-year-olds	14 19	13 2	15 4	13 0
,, —Three-year-olds	18 15	15 16	18 7	16 0
Herefords —Two-year-olds	16 16	14 14	16 17	14 6
Devons— ,,	15 2	13 1	15 2	13 8
Welsh Runts— ,,	14 9	13 8	15 6	13 15
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools	35 10	30 6	36 7	31 1
Store Pigs:—				
8 to 12 weeks old	28 8	23 4	29 2	23 9
12 to 16 weeks old	38 0	30 6	38 3	30 7

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in September, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham.		Leeds		Liverpool.		London.		Manchester.	
		per cwt		per cwt		per cwt		per cwt		per cwt	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF :—											
English	1st	56	6	55	0	53	6	59	0	53	6
	2nd	53	6	52	6	50	0	57	0	50	6
Cow and Bull .	1st	50	6	50	6	46	6	46	6	48	6
	2nd	43	0	46	6	41	6	42	0	43	6
Irish : Port killed	1st	—		53	0	53	6	57	0	—	
	2nd	—		50	6	50	0	53	6	—	
Argentine Frozen—											
Hind Quarters ...	1st	39	0	40	0	39	0	37	6	39	6
Fore ,, .	1st	29	6	30	0	28	6	27	0	28	6
Argentine Chilled—											
Hind Quarters ...	1st	48	0	46	6	45	0	49	0	45	6
Fore ,, ..	1st	30	6	29	6	28	6	31	0	28	6
Australian Frozen—											
Hind Quarters . . .	1st	37	0	37	0	34	6	37	6	35	0
Fore ,, ...	1st	30	6	29	6	28	6	27	0	28	6
VEAL :—											
British	1st	—		66	6	79	6	76	0	77	6
	2nd	70	0	62	0	70	0	67	6	71	6
Foreign .	1st	—		—		—		80	0	—	
MUTTON :—											
Scotch	1st	—		—		—		70	6	70	0
	2nd	—		—		—		66	0	65	6
English	1st	67	6	70	0	66	0	65	6	66	6
	2nd	60	6	66	6	61	0	61	0	62	6
Irish : Port killed ...	1st	—		—		66	0	—		—	
	2nd	—		—		61	0	—		—	
Argentine Frozen	1st	40	6	41	6	39	0	40	0	39	0
Australian ,, ...	1st	39	0	39	0	36	6	38	0	36	6
New Zealand ,, ...	1st	38	0	—		—		43	0	—	
LAMB :—											
British ...	1st	70	6	70	0	72	6	69	6	72	6
	2nd	66	0	65	6	64	0	65	6	64	6
New Zealand	1st	56	0	56	0	55	6	56	0	55	6
Australian	1st	53	6	—		49	0	46	6	49	0
Argentine ...	1st	50	6	51	6	49	0	—		49	6
PORK :—											
British	1st	76	6	72	6	74	6	71	6	74	6
	2nd	70	6	69	0	65	6	66	6	70	0
Foreign	1st	—		—		—		68	6	—	

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913.

Weeks ended (*in* 1913).	WHEAT.						BARLEY.						OATS.					
	1911.		1912.		1913.		1911.		1912.		1913.		1911.		1912		1913.	
	s.	*d.*	*s.*	*d.*	*s.*	*d*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d*	*s*	*d.*	*s.*	*d.*
Jan. 4	30	5	33	2	30	5	23	11	33	3	28	6	17	0	20	7	19	10
,, 11..	30	8	33	1	30	3	23	10	33	0	28	4	17	2	20	8	19	2
,, 18	30	11	33	4	30	5	24	4	33	3	28	6	17	4	20	11	19	4
,, 25 .	30	11	33	7	30	11	24	5	33	1	28	10	17	3	21	1	19	4
Feb. 1	30	9	33	8	31	1	24	5	32	10	28	11	17	5	21	3	20	2
,, 8	30	5	34	0	31	0	24	6	33	2	28	10	17	5	21	4	20	1
,, 15 ..	30	3	34	4	30	9	24	7	32	10	29	1	17	6	21	7	20	2
,, 22 .	30	2	34	6	30	11	24	9	32	8	28	8	17	7	21	9	20	7
Mar 1 ..	30	0	34	1	31	0	25	0	32	0	28	6	17	5	21	6	20	4
,, 8 .	30	1	34	1	31	3	25	0	31	7	28	5	17	5	21	8	20	0
,, 15	30	1	34	0	31	1	24	11	31	2	27	11	17	6	21	8	20	2
,, 22	30	2	34	1	31	1	25	0	31	10	28	6	17	5	21	9	19	11
,, 29 .	30	3	34	4	31	3	24	11	30	3	27	6	17	5	21	8	19	7
Apl. 5	30	4	34	10	31	4	24	7	30	9	27	0	17	7	21	11	19	2
,, 12	30	3	35	4	31	3	25	2	30	2	27	8	18	3	22	1	19	2
,, 19	30	4	36	7	31	6	25	5	29	11	26	11	17	10	22	4	18	10
,, 26..	30	11	37	10	31	8	25	5	30	4	26	7	18	3	22	9	19	3
May 3	31	4	38	1	32	2	25	7	30	2	25	11	18	6	23	1	19	6
,, 10 .	31	8	37	11	32	6	25	1	31	1	25	9	19	0	23	7	19	6
,, 17	32	6	37	8	32	10	25	4	31	2	25	4	19	2	23	7	19	9
,, 24 .	32	8	37	2	32	10	25	0	31	1	25	3	19	5	23	7	19	11
,, 31...	32	5	36	10	32	7	24	10	30	0	26	1	19	5	23	9	20	1
June 7 .	32	4	36	11	32	10	25	7	29	11	26	2	19	7	24	0	19	8
,, 14	32	3	37	0	32	8	23	11	30	8	24	7	19	8	23	10	20	2
,, 21	31	11	37	5	32	8	23	9	30	8	23	10	19	10	24	0	19	8
,, 28 ..	31	10	37	10	32	8	24	5	30	2	24	3	19	9	23	11	19	1
July 5	32	1	38	2	33	1	25	10	31	7	25	2	19	9	23	11	21	0
,, 12..	32	3	38	3	33	4	25	10	30	2	25	10	19	11	24	1	19	4
,, 19 .	32	5	38	10	33	6	24	3	30	9	24	9	19	5	24	8	20	5
,, 26	32	5	38	9	33	10	23	8	30	9	24	1	19	7	23	4	20	8
Aug 2	32	0	38	4	34	1	24	4	28	6	24	5	18	2	22	2	20	3
,, 9..	31	6	39	2	34	1	26	9	30	7	24	9	18	0	22	4	19	0
,, 16	31	6	38	2	34	3	27	8	28	3	24	7	17	10	21	8	18	7
,, 23	31	8	35	6	33	7	28	10	28	1	26	5	18	0	20	10	18	8
,, 30	31	7	34	10	32	7	28	4	28	6	29	0	18	3	20	8	17	10
Sept. 6	31	10	35	1	31	11	28	4	29	9	30	11	18	1	21	8	17	8
,, 13	32	0	33	5	31	9	29	0	29	0	31	5	18	5	20	5	18	0
,, 20	32	4	32	7	31	7	29	11	29	6	30	9	18	9	19	10	17	11
,, 27	32	6	31	7	31	6	30	5	29	9	30	1	19	1	19	5	17	9
Oct. 4	32	7	31	8	31	3	30	9	29	7	29	9	19	5	19	8	17	10
,, 11	32	9	31	10			31	0	30	4			19	10	19	5		
,, 18...	32	9	32	2			31	5	30	11			19	11	19	9		
,, 25	33	1	33	1			31	7	31	6			20	6	19	10		
Nov. 1 .	33	4	33	4			31	10	31	10			20	8	20	1		
,, 8	33	4	33	1			32	7	31	11			20	11	19	11		
,, 15 ..	33	1	32	10			32	10	31	2			21	0	19	9		
,, 22	33	0	32	1			33	5	30	11			20	10	19	11		
,, 29	32	10	31	9			33	10	30	8			20	11	19	8		
Dec. 6...	32	9	31	0			34	0	29	11			20	9	19	6		
,, 13 .	32	11	30	8			33	5	29	2			20	9	19	3		
,, 20...	32	9	30	7			33	5	28	11			20	8	19	1		
,, 27...	33	0	29	10			33	4	28	6			20	7	19	2		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

—		WHEAT.		BARLEY.		OATS.	
		1912.	1913.	1912.	1913.	1912.	1913.
		s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
France ·	August	48 1	47 8	30 3	29 7	23 8	23 5
	September	45 7	46 7	29 11	29 5	23 2	23 0
Paris	August	48 0	48 8	30 10	30 9	24 5	23 9
	September	47 2	47 9	30 10	30 6	22 7	23 2
Belgium ·	July	39 11	37 3	29 8	28 4	26 10	23 0
	August	36* 5	36 2	28 10	26 3	25 3	23 9
Berlin :	July	48 11	43 7	—	—	26 0*	22 9
	August	45 4	42 9	—	—	25 1	22 10
Breslau :	July	44 1	42 2	— * 30 1†	— * 26 0†	24 11	21 7
	August	41 6	42 4	31 2* 29 4†	27 8* 25 10†	25 9	21 10

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of September, 1912 and 1913.

—	WHEAT.		BARLEY.		OATS.	
	1912.	1913.	1912.	1913.	1912.	1913.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
London...	36 4	33 2	30 3	30 4	21 7	19 2
Norwich	33 11	31 10	27 9	29 4	19 11	17 1
Peterborough	30 10	30 11	27 7	30 8	18 4	17 5
Lincoln...	32 0	31 5	28 11	31 10	21 10	18 4
Doncaster	34 0	30 6	25 11	29 9	22 2	18 0
Salisbury	35 3	30 9	30 1	28 0	21 4	17 5

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in September, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol. First Quality.	Bristol. Second Quality.	Liverpool. First Quality.	Liverpool. Second Quality.	London. First Quality.	London. Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb	per 12 lb.	per 12 lb	per 12 lb.	per 12 lb.	per 12 lb.
British ...	14 0	13 0	—	—	14 3	13 3
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	114 6	111 6	118 6	115 6	118 6	114 6
,, Factory	103 0	96 6	104 6	95 6	104 0	102 0
Danish ...	—	—	130 0	127 6	128 6	126 6
French ...	—	—	—	—	117 6	110 0
Russian ...	104 6	100 0	106 0	102 6	103 6	99 6
Australian ...	110 6	105 0	—	—	110 6	106 6
New Zealand	—	—	—	—	—	—
Argentine	—	—	—	—	—	—
CHEESE :—						
British—						
Cheddar ..	76 0	71 0	74 0	72 0	80 6	75 6
			120 lb.	120 lb.	120 lb	120 lb
Cheshire ..	—	—	72 0	67 0	76 0	70 6
			per cwt.	per cwt.	per cwt	per cwt.
Canadian ...	67 0	64 6	66 6	64 6	67 0	66 0
BACON :—						
Irish (Green)	83 6	79 0	83 0	78 6	82 6	80 6
Canadian (Green sides)	77 6	74 6	77 0	74 0	77 0	75 0
HAMS :—						
Cumberland (Dried or Smoked) ..	—	—		—	133 0	126 0
Irish (Dried or Smoked)	—	—	—	—	118 0	114 0
American (Green) (long cut) ...	78 6	74 6	76 6	72 0	84 0	80 6
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	14 2	13 4
Irish ..	11 11	11 0	11 10	10 6	12 8	11 4
Danish	11 8	11 2	11 6	10 7	12 7	11 6
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
British Queen	86 6	80 0	66 6	60 0	80 0	68 6
Edward VII.	90 0	81 6	66 6	60 0	73 6	61 6
Up-to-Date	84 0	75 6	61 6	53 6	75 0	65 0
HAY :—						
Clover	—	—	84 6	61 0	84 0	—
Meadow	—	—	—	—	75 0	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	SEPTEMBER. 1913	SEPTEMBER. 1912.	NINE MONTHS ENDED SEPTEMBER. 1913.	NINE MONTHS ENDED SEPTEMBER. 1912.
Anthrax:—				
Outbreaks	30	28	411	594
Animals attacked ...	35	32	453	675
Foot-and-Mouth Disease:—				
Outbreaks	—	11	—	81
Animals attacked ...	—	191	—	633
Glanders (including Farcy):—				
Outbreaks	6	16	122	139
Animals attacked ..	7	24	304	256
Parasitic Mange:—				
Outbreaks . .	92	67	2,003	2,415
Animals attacked	152	95	4,003	5,189
Sheep-Scab:—				
Outbreaks ...	5	4	134	177
Swine-Fever:—				
Outbreaks . ..	152	127	1,868	2,345
Swine Slaughtered as diseased or exposed to infection	1,875	2,096	24,987	30,997
Tuberculosis:—				
Number of Premises notified	529	—	*2,537	—
Number of bovine animals notified as for slaughter	578	—	*2,781	—

* Since 1st May, when the Tuberculosis Order came into operation.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	SEPTEMBER. 1913.	SEPTEMBER. 1912	NINE MONTHS ENDED SEPTEMBER. 1913	NINE MONTHS ENDED SEPTEMBER. 1912
Anthrax:—				
Outbreaks	—	—	—	3
Animals attacked	—	—	—	3
Foot-and-Mouth Disease:—				
Outbreaks	—	5	—	29
Animals attacked	—	27	—	263
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked .	—	—	—	—
Parasitic Mange:—				
Outbreaks	4	1	102	53
Sheep-Scab:—				
Outbreaks ...	20	4	394	266
Swine-Fever:—				
Outbreaks	5	9	117	186
Swine Slaughtered as diseased or exposed to infection ...	46	35	713	1,517

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ENRICHMENT OF FARMYARD MANURE BY CAKE FEEDING.

A. D. HALL, M.A., F.R.S.

FOR many years the level of production on our best English farms has been far higher than can be sustained by the land itself, even when full advantage has been taken of such recuperative agencies as the growth of clover and other nitrogen-collecting crops. Lawes used to say that Hertfordshire land, similar to that on which the Rothamsted experiments are conducted, produced about 20 bushels per acre of wheat under the system of farming that prevailed when he began his work. This we may take to be what the land was capable of yielding under the old four-course rotation prior to the introduction of artificial fertilisers, &c. That the production has risen on the same class of land to something over 30 bushels of wheat per acre must be attributed to the extraneous sources of fertility which have become available to the farmer during the last seventy years or so. Now the English farmer has been accustomed to obtain this extra fertility from his land from two sources: (1) artificial manures like guano and nitrate of soda, or (2) imported feeding stuffs like linseed, cotton cake, and maize. Which source is the cheaper is not a question capable of any general answer, but there can be little doubt that the English farmer has generally preferred the feeding stuffs, partly because he has imagined that he got a double benefit out of the cake, &c., first as food, then as manure, and partly because he has known more about farmyard manure than about artificial fertilisers, and has always

had more confidence in its results. In an exact consideration of the question it is, however, necessary to distinguish and deal separately with the two-fold actions (1) of the feeding stuffs as food and as manure, (2) of farmyard manure as fertiliser and as an ameliorator of the soil because of the humus it contributes.

The manure value of a feeding stuff has received considerable study, and it is now generally agreed that at the most one-half of the nitrogen contained in the food reaches the land again in the dung. Indeed, Wood has brought forward evidence to show that the losses are even greater with rich cake feeding. But on this basis an estimate can be framed of the value of the fertilising material which a ton of any feeding stuff will contribute to the dung, so that we can regard the £9 paid for a ton of linseed cake at the present time as made up of about £2 4*s*. manure value, which will be found in the dung, and £6 16*s*. food value, which has to be paid for by the animals consuming the cake. Under a proper system of farm book-keeping every ton of linseed cake consumed is so charged out; £6 16*s*. is debited to the live-stock, and £2 4*s*. to the manure account. The advantage of this division is that it concentrates attention on the real results of the feeding. Too often a farmer will admit that his bullocks have not paid their cake bill, but he is content because he has the money back in the dung. That may be true, but let us split up the account in order to ascertain how much the bullocks have lost or made independent of the dung, and how much the dung has cost independent of the bullocks, for then it is easy to put the two operations together and see the profit and loss on the whole transaction.

From my own experience and from other farm accounts to which I have had access I have been convinced that of late years, since the great rise in the prices of feeding stuffs and the dearness of store cattle, the fattening of bullocks in yards has been generally unprofitable. Much has, of course, depended upon the chances of buying and selling, and the high price of beef more recently has perhaps turned the scale in the fattener's favour, but for all that the man who has relied on high cake feeding to get his bullocks out has

generally lost money in the process. Only exact account keeping can establish the truth or otherwise of this point of view, but when discussing it with farmers I have often been met by the argument that it is impossible to treat the question of bullock fattening by itself, since it is bound up with the whole system of farming followed. For instance, on a Norfolk farm on the lighter soils dung is a necessity, the straw must be trampled down and the turnips eaten, hence the bullock fattening is a necessity upon which the corn growing is dependent, even if the bullocks lose money and the dung appears very expensive in the accounts.

There is considerable truth in the view that farming operations must be viewed as parts of a whole on which the final profit or loss is estimated; but if the results of each stage are also scrutinised, methods of minimising the losses may often be discovered, for the routine of any farming system is rarely so inflexible as a conservative farmer likes to make out. The point requiring examination is the amount and nature of the fertility added by the cake feeding, after allowing for the loss of 50 per cent. or so of the nitrogen in the cake to which we have already made allusion. In order to obtain information on this score, experiments were instituted at Rothamsted in 1904 on the relative crop-producing powers of equal weights of dung made with and without cake, not only in the year of their application, but in three subsequent years. For the purpose of the experiment there were two series of five plots, arranged as below, forming part of a field containing eight such series

	1	2	3	4	5	
A.	No manure	1904 1908	1905 1909	1906 1910	1907 1911	Ordinary dung.
B.	1904 1908	No manure	1905 1909	1906 1910	1907 1911	Cake-fed dung

of plots, the other six dealing with artificial manures not here considered. In each series there is a check plot which remains unmanured, then the manure is applied each year to one plot only, *e.g.*, to 2 A in 1904, 3 A in 1905, 4 A in 1906, and 5 A in 1907, the other plots remaining without dressing. Thus

in 1907 plot 5 A would show the result of an application of the manure for that crop, plot 4 A the result of an application in the previous year of the same amount of manure from which a crop had already been grown, plot 3 A the result of an application two years, and plot 2 A three years previously, while 1 A remained as the continuously unmanured standard. At the end of four years it was considered that the manure would be pretty well worked out, and the application was renewed on 2 A, progressing year by year as before, so that in any given year there was always a plot manured that year, and others one, two, and three years previously.

To obtain the dung for the comparison, two sets of bullocks were set apart each year with the same allowance of litter, one with roots and hay only, the other with roots and hay plus the usual allowance of 4–8 lb. of cake or other concentrated food. The dung made was sometimes carted straight out to the land, sometimes it had to be made up into a heap for a month or so until wanted, but finally, after each heap had been well mixed, equal weights were put on the plots at the rate of 16 tons to the acre, samples being drawn for analysis at the same time. No attempt was made to ascertain how much of the fertilising material in the cake had found its way into the dung, as the point to be tested was only the relative producing powers over a period of four years of rich and poor dung. The plots were farmed on a rotation of alternating roots and corn—swedes, barley, mangolds, wheat—clover being omitted because it introduces nitrogen from the atmosphere.

The analyses of the manure are perhaps the first point of interest. What differences should be expected? In both cases the straw will contribute a considerable proportion of nitrogen in an insoluble and comparatively slow-acting form. Then in the food we must distinguish between the nitrogen that is digested, the greater part of which reappears in the urine in the soluble and active form of urea, and the undigested compounds which pass through into the fæces and will be very slowly changed in the soil into plant food. Of the nitrogen compounds in hay less than half will be digested, so that the hay will mostly add to the insoluble and slow-acting materials in the fæces, whereas more than three-quarters of the nitrogen

compounds in the cake will be digested and will add to the soluble compounds in the urine. It follows that cake-fed dung should be distinguished from the ordinary article, not only by a greater richness in nitrogen, but by having most of this extra nitrogen in a soluble and active form, as urea or the ammonium salts, into which urea is almost immediately converted on exposure, and this expectation is borne out by the following analyses, which represent the average composition of the two samples of dung thus made for the experiments at Rothamsted:—

	Dry Matter	Nitrogen			
		Total	As Ammonia	As Amides, &c Soluble	Insoluble
From Roots and Hay only	2 54	0 530	0 043	0 069	0 418
From Roots and Hay with Cake	2 66	0 701	0 147	0 118	0 436

It will be seen that as regards the insoluble compounds of nitrogen the two kinds of dung are much alike, but the cake-fed dung has a great superiority in ammonia and amides—on the average more than double as much. Now, when the dung comes to be used, the ammonia and amides will be immediately available and will feed the crop that occupies the ground, but, as we have learnt from other experiments at Rothamsted, the effect of ammonia is confined to the year of application: whatever is not used by the first crop is wasted and not retained by the soil to help successive crops. The insoluble compounds, on the other hand, while only very partially helping the first crop, are retained by the soil and keep slowly coming into action; they confer upon farmyard manure its lasting manurial action, one that has continued in some of the Rothamsted experiments for a full half century. Let us now see what crops the two kinds of dung yielded at Rothamsted, both as regards their immediate and residual effects. Nine years' results are now available, and in order to render them more intelligible, it will be convenient to consider the ratios between the weights produced on each plot rather than the actual weights, because the crops vary from

year to year with the rotation, and we have to compare swedes one year with wheat the next. In each year the yield of the unmanured plots is reckoned as 100, and the yields on the other plots are reduced to that standard. Without going into the details each year, the following table gives the mean results:—

	Yield—total produce (unmanured plot = 100)			
	Year of application	Second year	Third year	Fourth year
	Mean of 9	Mean of 8	Mean of 7	Mean of 6
Dung from Roots and Hay only	134	123	114	106
Dung from Roots and Hay with Cake	165	132	113	108

These results are very significant, and are in exact accord with the expectations we should form from the composition of the two kinds of manure. In the year of application the "cake-fed" dung has a great superiority, producing double the increase of crop that the ordinary dung gives, *e.g.*, if the yield on the unmanured plot was 3 qr. of wheat, 16 tons per acre of ordinary dung would raise it to 4 qr., and 16 tons of cake-fed dung to 5 qr. per acre. The second crops grown with the dung are, however, much more nearly alike; the residue from the ordinary dung has raised the crop by one-quarter, the residue from the cake-fed dung by one-third. In the third and fourth years the superiority of the cake-fed dung has entirely disappeared, though both kinds are still effective in producing an increase of crop over the unmanured plot. From these experiments we may draw the conclusions that the *extra* value conferred upon dung by cake feeding is not of an enduring nature; the first crop grown with the dung gets the benefit and, to a slight extent, the second, but the added fertility due to the cake feeding has not the lasting effect of the dung itself. It is evident that compensation for cake feeding should not be carried back for more than two years prior to the end of a tenancy, *i.e.*, when the tenant has grown two crops with the dung he will be leaving behind in the soil no appreciable fertility due to the cake and corn he has fed, even in a soil as cool and retentive as that of Rothamsted.

One further consideration is suggested: if we distinguish between the immediate fertilising effect of dung, due to its ammonia and kindred compounds, and its slow, lasting action, it is clear that the cake feeding has enriched the dung in the former sense only, but has added little or nothing to the latter. Cheaply made dung, in fact, produced from roots and hay alone, will do as much to ameliorate the soil, give it water-retaining power and slowly acting reserves of fertility, as dung made from the most highly fed bullocks. Moreover, the ammonia that cake feeding confers on the dung can be purchased directly in the form of an artificial manure, and purchased far more cheaply in sulphate of ammonia than in linseed cake at the present range of prices. The farmer on light arable land, who must have dung to maintain the humus in his soil, can make manure which is just as valuable from this point of view by trampling down the straw with bullocks receiving roots and hay only, and can then provide the necessary enrichment with active nitrogen by means of a hundredweight or two of sulphate of ammonia.

The practical lesson, then, suggested by these experiments is that on light arable soils, where dung is so very necessary, but where bullock-fattening is in itself an unprofitable operation, no harm will be done to the land if the cake bill is reduced to the lowest amount that is possible. Instead of pushing his bullocks with 8–10 lb. of cake per diem on the otherwise sound principle that the quicker the fattening the greater the profit, the farmer may treat his bullocks as mere dung-making machines and set them to trample down their maximum of straw by feeding them on roots and hay only, and so keeping them on hand a long time. In the last month or so an allowance of cake will be necessary to finish them off, and the slight enrichment thus effected will help the dung to rot down more quickly. When the land comes to be manured, 20*s.* to 30*s.* an acre may be needed for sulphate of ammonia or other nitrogenous fertilisers, in order to make up for the poorness of the manure, which will, however, be just as valuable as the rich dung in keeping up the humus content and texture of the soil. As a rule, however, the farmyard manure is quite nitrogenous enough for the root crop to which it is applied, and the farmer will do better to

keep his extra nitrogen in hand, as it were, to apply to whatever crop in the rotation will best repay its use, than to put it all on automatically for the roots. If the roots are swedes and are followed by barley, the nitrogen is misapplied. In any case, instead of a cake bill that often amounts to £10 per acre of root land, the farmer will have a much-reduced expenditure on fertilisers.

There appears to be only one experiment on record in which bullock-feeding has been considered from this point of view, and that was carried out on the Norfolk Experimental Farm in the years 1909–12. The two lots of bullocks were fed, one with a large allowance of cake, 6–10 lb. per diem, the other with no more than 1 lb., and though the cropping returns were rather disturbed by the dry season of 1911, the final result, taking into account both the results of the fattening and of the subsequent crops grown with the dung produced, was distinctly against the heavy cake feeding.

More experiments of the kind are desirable, experiments that involve, as the agricultural experiments of the future are all likely to do, systematic account keeping as well as a record of yields, because there is a practical issue at stake which would affect the practice of many of the best farmers in the country. It is with some hesitation that one suggests that men of so much experience are working on wrong lines, but I believe that many excellent farmers are persisting in a method of obtaining fertility that once was good, but has now become unprofitable at current prices for feeding stuffs and store cattle.

SOME CAUSES OF INFERTILITY IN PEATY SOILS.

EDGAR E. STOKES.

Agricultural Organiser for Nottinghamshire

IN the Eastern Midland Counties of England there are considerable areas of peaty fenland, some of which, after reclamation, are extremely fertile. For the most part they are low-lying level areas, frequently not more than a few feet above sea-level, and are therefore distinct from the high peats or moorlands which as a rule are more common in other

counties and on the Continent. With both types of soils drainage is the first step towards improvement, but it is unfortunately much more expensive in the former, owing to the absence of a natural fall, and the necessary provision of pumping machinery. It is proposed to deal with deterioration of the low-lying peaty land after improvement, rather than with the initial operation of drainage, which is practically an engineering problem.

The various experiments described below were carried out in the extreme north of the county of Nottingham, on land fairly typical of the peaty country there, although its peculiarities were perhaps more marked than usual. Lying between the river Idle on the west and north, and a long range of hills on the south, is a tract of land known locally as "The Cars," about fifteen miles long by two miles broad, and containing some 6,000 acres. It is really a continuation of the more extensive area over the river in South Yorkshire, known as the "Level of Hatfield Chase." The part more particularly concerned is situated in the parishes of Scaftworth, Everton, Gringley, Misterton and Walkeringham. For convenience the term "The Cars" may be continued, but it should be noticed that in the adjoining counties any level and extensive tract of land may be so named.

In 1905 the Midland Agricultural College were consulted by the Trustees of the Magnus Charity, who are owners of land in Everton parish, for advice* and assistance in regard to part of their estate lying within the Cars. Besides showing that the water-level was very near the surface, an inspection seemed to indicate that it was a manuring question, and a series of trial plots was laid down. Later on the plots were extended to include systems of cropping and kinds of crops most suitable for land of this character.

Although it will be necessary to allude to the whole series of experiments, this article refers especially to events of the last two years, during which period they have been under the writer's control.

Although included in the map accompanying Lowe's "Survey of the Agriculture of Nottinghamshire," no reference is made to this part of the county in the text of the

* White's "Nottinghamshire"

survey. From another source* we learn that all the Cars were enclosed by April, 1776, and that they were drained under Acts of Parliament passed in 1796, 1801, and 1813. It is stated that, although the proprietors carried out the work at great expense, they were amply remunerated by the improved value of the soil. This fact is corroborated by many of the older inhabitants of the villages around, who say that enormous crops were grown year after year. Traditions such as these gather in magnitude as the years go by, and as it was doubted that such a soil could possibly have borne the immense crops credited to it, more information on this point was sought. Practically the only details available appear to be contained in the *Journal of the Royal Agricultural Society* for 1845, where R. W. Corringham speaks of the Cars as having at first produced abundant crops of rape and oats, "which gave promise of a fertility quite extraordinary, and which was for a time fully realised." Even allowing a liberal discount from local traditions, there can be no doubt that the land has depreciated in fertility to a very remarkable extent.

In the article referred to it is further explained that the practice of paring and burning increased the fertility for a time, but in the end proved decidedly injurious to the land, by reducing its surface below the drainage then provided for it. Thus it became necessary to instal power for the purpose of pumping, and in 1828, on the advice of a committee appointed to deal with the matter, the requisite machinery was installed at a cost of more than £6,000. The consolidation and shrinkage of the land still went on, however, under cultivation, and ten years later more pumping machinery was installed at a cost of £5,000.

When marshy land is reclaimed it is imperative that sufficient allowance should be made for its subsequent shrinkage and consolidation, the soil naturally occupying less space when its surplus water has been removed. In a peaty soil an added allowance must be made for loss by decay of the peat, when stirred about in cultivation and brought into contact with the air. Further, the nature of the crops grown is bulky, especially the cereals, and as crops are generally sold off year by year, the soil itself becomes less and less. The

rate of shrinkage seems to be dependent on the depth of the peat layer, and an illustration of this phenomenon from the Lincolnshire fens will give an idea of its relative importance. Skertchly, in the "Geology of the Fenland," gives an instance of one area sinking 2 feet in sixty years (1806–1866), being at the rate of 0·4 inch per annum, or 40 inches in a century.

To maintain an efficient drainage it is necessary, in all areas under pumping, to lower the sills and channels from time to time. The actual cost of the pumping, of course, increases with the amount of lift, and although compensated for to some extent as time goes on, by the more recent improvements in engine and pumping machinery, the charge per acre to cover it becomes an increasing burden. If finality in this respect is ever reached, it will not be until the peat is more or less worked through, or until it has become to some extent intermixed with the clay stratum, almost invariably to be found underlying. In the early years of cultivation the shrinkage is comparatively rapid, and, as will be seen from the description given and to follow, the conditions in this part of Nottinghamshire are particularly favourable for a general subsidence of this nature. There can be no doubt that the primary cause of depreciation in the fertility of this land is inadequate drainage, the water-level being too near the surface, especially towards the middle of the Cars, and while the edges of the Cars bordering the high land are probably nearly as good as ever they were, the centre has become almost useless. In the central portion the soil is almost pure peat, and, judging by the water-levels, has sunk lower than the outsides by about 18 inches or 2 feet. This is generally admitted, as also is the obvious remedy of increasing the pumping facilities, and of following history by lowering the sills and channels. Under the changed conditions of agriculture, however, it is by no means certain that the outlay would be sufficiently remunerative, and it was decided to ascertain first of all what could be done by an improvement of other conditions.

A piece of land four acres in extent near the middle of the Cars was selected for experiments, and was divided longitudinally into eight plots for manuring purposes, and trans-

versely into a similar number for cropping purposes, giving altogether sixty-four plots, each of them being $\frac{1}{16}$th acre. No. 1 plot was ploughed as before, and was unmanured. No. 6 was ploughed shallow, while the remainder were ploughed deeply. It may be noted that the expense of deep cultivation on this land is very considerable, owing to the large amount of "bog timber" it contains. This seems to be moving nearer the surface, and even in ordinary cultivation is a great nuisance. A quantity was removed where the land was deeply ploughed, but the expense of removal on a large scale would be a very serious item. The benefits of such deep tillage, moreover, appear to have been very limited.

The soil itself consists almost entirely of decayed or partially decayed vegetable matter, and in comparison with other peats seems to contain a larger proportion of decayed wood and less of foliage, roots, grasses, and other finer and more fibrous material. On the area selected there is normally about 18 inches depth of what is termed "dry" peat (presumably above the water-table), which has been more or less broken up by cultivation or by the oxidation following those operations, and then about 3 feet of wet peat, which is constantly water-logged, and has never been disturbed.

The principal items of the chemical analysis of the top soil were as follows:

Moisture (Hygroscopic) .	15 42	per cent
Organic Matter (Loss on Ignition)	57 76	,,
Nitrogen (N) ..	2 11	,,
Potash (K_2O)	0 60	,,
Lime (CaO) .	1 06	,,
Magnesia (MgO) .	0 28	,,
Phosphoric Acid (P_2O_5)	0 26	,,
Silica	17 46	,,

with traces of iron in the ferrous state.

Even for a peaty soil the percentage of organic matter is extraordinarily large; consequently the total nitrogen is high, although, as indicated by the total absence of nitrates, it is in an unavailable form. The soil was found to be very acid. The prevailing weeds are spurrey and various species of *Polygonum*, which, together with rushes and an abundance of *Holcus lanatus* and *H. mollis* in the pastures, indicate a condition of wetness and acidity.

Without going into details, the results of the manuring experiments may be summarised by saying that they failed to give an adequate return. Small dressings of lime, phosphates, and potash, together and separately, were found to have practically no effect, while the larger dressings, though materially improving the land, were certainly not remunerative. Plot 4 may be taken as an example. This plot received in 1906 a dressing of 4 tons lime, 8 cwt. basic slag, and 4 cwt. kainit per acre, and again in 1908, 2 tons lime, 8 cwt. basic slag, and 1 cwt. sulphate of potash, the total cost for manures being at the rate of £7 12*s*. 6*d*. per acre. On turning to the credit side of the balance sheet, there are such items on portions of this plot as 5 qr. of oats in 1907, 3 tons of potatoes in 1908, and total failure of the crop in 1906 and 1909. Ignoring the hay crops gathered during that time, the gross return for the whole half-acre manured at the rate mentioned is estimated at about £2 per acre per annum for the five years subsequent to 1906. Such a result from a practical point of view was disappointing, and it was eventually decided to discover what could be done in other directions.

The deep and thorough cultivation referred to failed to promote a sufficient rate of nitrification for the requirements of the crops, and consequently nitrogenous manuring was resorted to in 1907, and again from time to time in subsequent years. Nitrate of soda, nitrate of lime, and calcium cyanamide have been used, and although other factors have interfered, the evidence obtained is sufficient to indicate that the *total* nitrogen content of such soils as these may be of little or no use for the current requirements of a crop.

Inoculation by bacterial cultures has been tried with the seeds of oats, grasses and clovers, but without any distinct benefit. The same conclusion also applies to the use in 1907 of certain insecticides.

Having shown that nothing substantial could be gained by the use of the manures mentioned, attention was next given to the possibility of laying down the land to permanent grass, and for the last three years six of the eight plots have been treated with this end in view.

No difficulty has ever been found on the plots in getting seeds of all kinds to germinate, and initially there

has always been a fair "plant" of seedlings, and in most cases the young braird has been very good indeed. The autumn-sown crops, such as wheat or rye, sometimes lose plant in the winter. This is chiefly due to the presence of an excessive amount of moisture, which rots the deeper roots, and to frosts which loosen the root system and expose part of it to drying winds. Examination showed that the winter roots of cereals were mostly adventitious and near the surface, and that the deep tap-roots found under ordinary conditions were absent, having probably been rotted off by the stagnant water, which during the winter is normally not more than 6 to 8 inches below the surface of the ground. Although the loss sustained during winter was always of a partial nature, in many cases the entire crops of both winter and spring cereals died off in the early part of the summer, generally about the middle of June. For this phenomenon there may be four causes: (*a*) insect pests; (*b*) frosts; (*c*) insufficiency of plant food; (*d*) lack of moisture; and there can be no doubt that the first two at least do occasionally cause much damage in this district. The area, being low-lying and practically unsheltered, is very prone to late frosts which are much more severe than on the higher lands around, while wireworm and similar pests are generally abundant in the soil.

In the spring of 1911 one of the half-acre plots was sown with Carter's White Cluster Oats, purposely rather late in the season to avoid the frosts. They came very well indeed, kept a good colour, and were extremely promising until the second week in June, when in the course of a few days the whole crop withered and died. Examination of the soil showed that there were at that time few insects present, and indeed the complete disappearance of the crop in so short a time was not characteristic of an insect attack. The soil had been well manured with phosphates and potash in preparation for the crop, and a moderate top dressing of nitrate of soda had been applied about a fortnight beforehand, so that there could have been no deficiency of plant food. As regards insufficiency of moisture, the water-table at that time was only 1½ to 2 feet from the surface, and even with such a moisture-retaining substance as peat, it could hardly be supposed that a strong and vigorously growing crop could

not, if need be, have drawn its water requirements through that short distance.

Attention was next given to the possibility of frost being the agent responsible. This appeared to be much more likely, as the whole of the plot was so uniformly affected, and at first the tips of the leaves only were discoloured, in a manner apparently quite consistent and usual with this cause. Inquiries, however, elicited the fact that any frost occurring in the district must have been very slight and quite insufficient to have caused extensive damage. The tops of potatoes growing close to the plots were unaffected, and after careful inquiry it was concluded that frost, if present at all, was too slight to have caused such a complete destruction of the crop.

In considering the matter further, it appeared strange that the damage to this crop and to others which had failed should apparently almost every year synchronise with the approach of summer—in other words, with a less abundant supply of water. The destruction of the crop, too, appeared as if caused by the wholesale distribution of some plant poison. It seemed possible that when the crop became so abundant that the rainfall was insufficient for its moisture requirements, it would be forced to draw upon the underground supplies, and that the latter, in rising to the roots, might extract from the peat, in passing through it, some deleterious substance, which would act as a poison to the crop. In view of experiences with alkali soils abroad, it appeared possible that so long as the movement of water was in a downward direction the soil would be healthy, and any injurious principle present would tend to be leached or washed farther from the plant. Conversely, if the surface were allowed to become dry, the water movement would be in the reverse direction, and would bring back with it those injurious salts in a more concentrated solution, and deposit them on evaporation near the surface.

In order to test the injurious effect of the Cars water to crops after having passed through the peat, a quantity was taken from the dykes and used in pot cultures. Three pots were planted in July, 1911, with oats, one being watered with Cars water taken as described, one with tap water, and the other with distilled water. The following year also a more

extensive experiment was carried out, and the pots were exhibited at the Royal Agricultural Show at Doncaster.

In the former series (1911) the differences between plants grown with water from different sources were sufficient to indicate clearly the existence in peaty soils of a substance injurious to plant growth. The second series (1912) indicated less clearly that this substance is actually brought to bear on the plant during the rise of water when the surface supply becomes insufficient for the requirements of the crop. The exact nature of this substance is undetermined, but it is suggested that it is not improbably an organic compound, possibly present in minute quantities, and acting as a toxic substance.

These experiments have an interesting bearing on the susceptibilities of different crops to conditions of acidity. Oats and rye are the usual cereals grown, and we have had fair crops of both on the experimental area, but also, it must be confessed, complete failures of both. Wheat has been tried from time to time without much success, but in this case failure has nearly always been partial, and the result of the loss of plant in the winter. Potatoes are frequently grown, and if well manured they often give fair crops, provided they escape the late spring and early summer frosts. The quality, however, is defective, and they are liable to be injured by wireworm.

The most noticeable failure of crops in these experiments has been with mustard, which has been tried several times, both in pots and in the field, and has invariably failed to grow more than about 2 inches high. In the middle of the field, which is slightly higher than the remainder, it has persisted a little longer. The reason for this, it is suggested, is not the actual drier conditions of soil, but that it takes rather longer for the standing water below to penetrate upwards through the peat. In the second series of pot experiments several conditions of moisture were tried, varying from very wet to very dry, but without any apparent effect on the growth of the mustard.

Information on this subject appears to be very scanty, but it may be noted that Hall ("The Soil," page 286) says: "Of the common crop plants, oats and potatoes are perhaps the most tolerant of extreme amounts of acid humus."

Coming now to the commercial possibilities of this land, it seems extremely doubtful whether, under present conditions of agriculture, the low-lying middle portion can be profitably treated and cropped as arable land. The phenomenon just described, together with the disastrous effect of late frosts, the difficulty of tillage operations due to the bog timber, the weediness of the land, and the very loose character of the soil, combine to make the success of arable crops extremely uncertain. Such drastic measures as claying the land are impossible because of the expense, and perhaps improvement by laying down to pasture is the most feasible of all suggestions. At present the greater portion is under rough grass, but owing to the extensive growth of rushes it is ploughed up about every three or four years, and then again seeded down. Rye grass, timothy, and foxtail appear to be the most suitable grasses for this purpose, but they are invariably smothered or crowded out by the natural growth of *Holcus lanatus* and *H. mollis* in the course of about two years. To prevent this the land used for pasture should be continually and closely grazed, and as far as possible never allowed to become coarse and rank. By such means the finer grasses would be encouraged and a closer turf would be obtained, similar to that which may now be seen on the roadsides. It is possible also that basic slag and other forms of phosphates would do more good when applied to pasture than they do at present to arable land.

As regards the rushes, there is no doubt that their presence is due to excessive moisture, and there can be little hope of exterminating them until the water-level is considerably reduced. They might, however, be kept in check on the grazing land referred to by frequent mowing, say two or three times in a season, or sufficiently often to keep the land permanently in grass and obviate the necessity of ploughing it up every few years. Land required for hay should be kept distinct from the grazing land, and would have to be treated on much the same lines as at present.

It should be mentioned that half the plots were drained in 1910, but, owing to the impossibility of securing low outfalls, the tiles were of necessity placed very shallow. They are

probably not deep enough to check the growth of the rushes, and they soon become displaced when laid on peat.

If treated in the manner described there seems to be no reason why the Cars should not form very useful summer grazing when farmed in conjunction with the arable land around, the greater part of the live-stock being removed from them in the winter. This is being done to a limited extent at present, but if the pasture can be improved in the manner indicated, and if the practice can be systematised, it is capable of much greater development.

SILVER-LEAF DISEASE.

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As the name implies, the foliage of a tree affected with Silver-leaf disease presents a silvery appearance. The silveriness varies somewhat according to the kind of plant affected, though it is difficult to define the slight differences which exist. Thus the colour of a silvered apple leaf is not quite the same as that of a silvered plum leaf, nor even is a silvered leaf of a Victoria plum identical in colour with that of a Czar. There is, however, a general similarity in the appearance of the foliage of affected plants which justifies the common designation of Silver-leaf. The silvery sheen is due to the formation of air cavities in and below the epidermis or skin of the leaf, the accumulation of air in these places causing a change in the character of the light reflected from the surface. When sections of silvered leaves are cut there is a tendency for the cells to fall asunder.

The silvering of foliage is a widespread phenomenon which affects a great variety of plants, though it is much more common in fruit trees than in other plants. Plum trees, apple, cherry, apricot, peach, red-currant, and gooseberry, especially the two first mentioned, are frequently affected by Silver-leaf, but cases of this disease have also been recorded in such different plants as horse chestnut, sycamore, laburnum, Portugal laurel, walnut, syringa (*Philadelphus*), the white dead nettle and others.

The disease is of economic importance only in the case of fruit trees, and evidence shows that it is becoming more and more serious in the fruit-growing districts of this country, especially where Victoria and Czar plums are grown on a large scale. Silver-leaf has been reported from fruit-growing districts in New Zealand, South Africa, and Canada. The disease is also present in various European countries.

The usual course of the malady in the case of a plum tree is as follows:—At first a single branch of the tree shows silvering of the foliage, which in the course of a year or two spreads over the rest of the tree. In serious cases the silvered leaves sometimes become brown, and die as the summer advances. When silvering has become general the extremities of the branches which have been longest affected begin to die back, and gradually the whole tree succumbs, so that from the time of being first affected death results in a few years. As the death of the branches proceeds, fructifications of the fungus *Stereum purpureum* develop upon them, and Professor Percival, Mr. Spencer Pickering, and the writer have shown by inoculation experiments that this fungus is the chief cause of the disease in the fruit-growing districts of this country. The writer has cultivated *Stereum purpureum* under conditions which prevented its contamination by other organisms, and such material of the fungus used for inoculation has induced Silver-leaf disease in a large percentage of cases. The disease has also been induced by placing the spores of the fungus under suitable conditions in wounds made in fruit trees.

We have shown that Silver-leaf in plants is a manifestation of ill-health which may be due to different causes, although from the practical fruit-grower's standpoint the fungus *Stereum purpureum* is the principal agent in this country. Thus in the case of silvered dead-nettle plants, and in the case of certain seedling plums, &c., which have come under observation, no sign of fungus attack was evident, hence silvering of these plants could not be attributed to *Stereum purpureum*. In this connection it may be pointed out that in the diseases of plants and animals it is by no means unusual for the same outward manifestation of disease to be due to different causes; thus tumours both in plants and in animals are induced by

a variety of means. Mention may here be made of a phenomenon seen by the writer in the South of France during March, 1913, which, though not genuine Silver-leaf disease, closely resembled it. The foliage of various plants such as myrtle, arbutus, &c., presented a silvery appearance, which was due to the puncturing of the epidermis by some insect. In this country attacks of Red Spider on plum foliage sometimes produce an effect which might conceivably be mistaken for Silver-leaf disease by those who have not had experience in diagnosing the latter. In such cases the structure of the leaf is not affected as it is when Silver-leaf disease proper is present.

As the fungus *Stereum purpureum* is chiefly responsible for the development of Silver-leaf in this country, this article will deal principally with the part played by it in causing the disease. Infection of fruit trees is caused by wind-borne spores of this fungus, which, alighting on wounded surfaces of the trees, germinate and penetrate to the tissues below, from which the mycelium or spawn of the fungus spreads both upwards and downwards. As is the case with certain other tree-destroying fungi, it is probable that only an exceedingly small percentage of these spores cause successful infection, hence the disease does not usually develop in an epidemic manner like rust on wheat, or mildew on gooseberry bushes.

In the early stages of attack the wood is the only part affected, and frequently a narrow zone of the youngest wood remains uninvaded for some time, though sooner or later both this and the bark become affected. The fungus spreads much more rapidly in a longitudinal than in a lateral direction, and in the case of the larger branches and trunk of the tree it may spread for a long time in the wood without any sign of injury to the bark being evident. The wood and bark which are invaded by the spawn of the fungus become dark brown in colour, the discoloration being chiefly due to the accumulation of a gum-like substance in the cells. So abundant is the gum produced by the fungus in plum trees that large masses of it sometimes exude from the bark. The fungus may spread from the trunk into the root system of the tree. The amount of discoloured wood, as seen in a cross-section of a silvered branch, varies according to the length

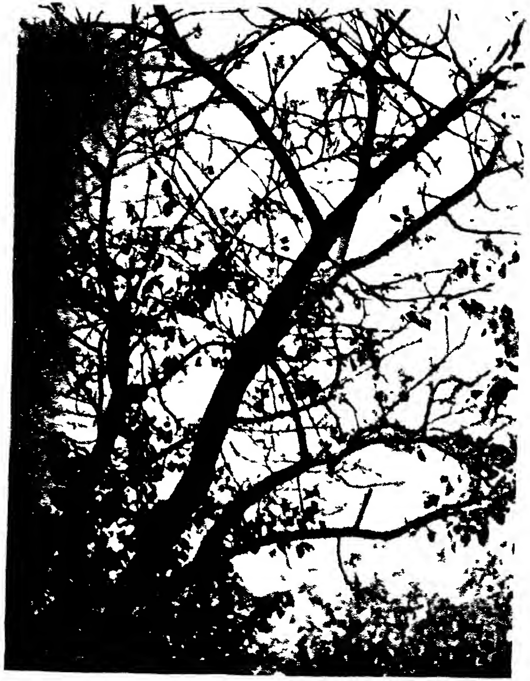


FIG. 1.—Upper part of silvered Victoria Plum tree one branch of which is dead and bears fructifications of *Stereum purpureum*

FIG. 2.—Fructifications of *Stereum purpureum* on dead branch of Victoria Plum tree

FIG. 3.—Lower part of trunk of silvered Victoria Plum tree showing fructifications of *Stereum purpureum* which developed shortly after the upper part of the tree was cut off

of time the tissues have been affected by the fungus. Fig. 4 * shows a section of a branch of a silvered Transparent Gage tree, in which more than half the wood is diseased. The discoloured wood is often a considerable distance below the silvered leaves. Thus in the immediate vicinity of the affected foliage there may be no discoloured wood, but if search is made farther down the branch or in the trunk of the tree, diseased tissues will probably be found, the silvering of the leaves being due to some disturbance caused by the presence of *Stereum purpureum* below.

As the branches of an affected tree die, the fructifications of *Stereum purpureum* appear on the bark. One frequently sees silvered plum trees, the dead branches of which bear fructifications in abundance. Fig. 1 shows a part of a silvered Victoria, in which one branch is leafless and bears the fructifications of the fungus, the other branches carrying silvered leaves. The fruit bodies of *Stereum purpureum* are variable in form, as is indicated in Figs. 2 and 3. Sometimes the fructifications occur as incrustations several inches long, covering the under-surfaces of branches; at other times they project from the bark to a distance of ¼ in. to ½ in., and are densely crowded one above another. When young and moist, the fructifications are purplish in colour (hence the name), but they become dingy with age. If free from the bark the upper surface is hairy, but the under, spore-bearing surface, is smooth. Under moist conditions the fruit bodies are leathery in consistency, but on drying they shrivel up and become brittle. The dry fructifications possess the power of expanding again when moistened. The fruit bodies can do this repeatedly, and may give rise to myriads of minute colourless spores each time they become moist.

The fructifications of *Stereum purpureum* may be found at all times of the year. They develop from the spawn of the fungus only after spells of wet weather, and appear in particular abundance after heavy rains during the autumn.

In addition to developing on silvered fruit trees, the fructifications of *Stereum purpureum* are commonly found on various kinds of dead wood and bark, such as willow, poplar,

* Thanks are due to the Cambridge University Press for kindly giving permission for the Figures to be reproduced and for granting the use of the blocks.

birch, beech, and sycamore, these being portions of trees which, when living, were not affected by the fungus. *Stereum purpureum* taken from a silvered laburnum will cause Silver-leaf in plums, and *vice-versâ,* and it has also been shown that *Stereum purpureum* taken from a dead birch stump in the midst of a wood is as effective in causing Silver-leaf as *Stereum purpureum* taken from a silvered plum tree. This fungus, therefore, considered as an effective agent, is not confined to closely restricted groups of host plants in the manner of certain rusts and mildews, and it must be looked upon as a potential agent in causing Silver-leaf on whatever substratum it may be found. *Stereum purpureum* belongs to that class of fungi which may develop either on dead or upon living tissues. It can only grow as a parasite, and thereby attack living tissues, after developing upon dead tissues (*i.e.,* saprophytically) in its initial stages. Thus in causing infection of a fruit tree the spores of *Stereum purpureum* germinate upon a wound, and the developing mycelium, after gathering strength by living on the dead tissues around the wound, penetrates the healthy wood below. The greater part of the wood of a healthy tree consists of dead cells, so there is nothing unusual in the development in such tissues of a fungus like *Stereum purpureum,* which commonly grows as a pure saprophyte.

It has already been pointed out that Silver-leaf disease is becoming increasingly prevalent in this country, particularly in those districts where plums are grown on a large scale. The marked increase of the disease during 1913 may perhaps be correlated with the extremely wet summer of 1912. Such a sequence has been noticed on previous occasions. Victoria and Czar are the two varieties most liable to the disease, and in some neglected plantations of the former kind great havoc has been caused by it, the losses amounting in several cases to more than 60 per cent. of the trees. The following varieties of plums have also been observed to be affected with Silver-leaf, but they are much less susceptible than are Victorias and Czars:—Early Rivers, Pond's Seedling, Monarch, Gisborne, Transparent Gage, Purple Gage, Green Gage, and Damson, a list which is probably not complete. Wild sloe trees are also sometimes silvered. It is

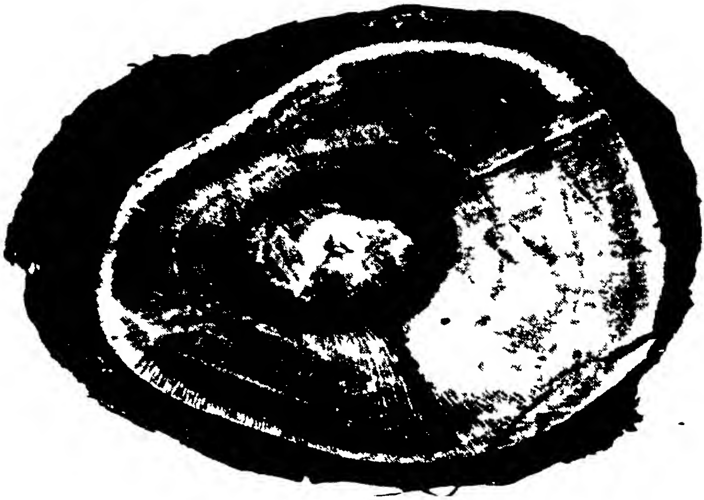


FIG. 4.—Cross section of branch of silvered Transparent Gage tree showing diseased and healthy wood. Twice natural size.

FIG. 5.—Blenheim Orange Apple tree that has died after being regrafted with scions of "Grenadier" or "Jubilee." The scions also have died and the stock bears fructifications of *Stereum purpureum*.

not often that young trees are affected by Silver-leaf, and only a few silvered plum trees less than five years of age have come under my observation. The disease usually appears in a plum plantation as the trees are coming into full bearing, the affected trees being dotted about in an irregular manner. As silvering becomes general on a tree, its cropping power decreases, and finally ceases as the branches die back. If such trees die and the fungus develops upon them, it is probable that the disease will become increasingly serious in that plantation. Thus in one garden in which a large number of silvered Victorias bearing *Stereum purpureum* were allowed to remain untouched, there were seventy-five healthy plum trees in 1910, but only fifty-eight remained unaffected by Silver-leaf in 1912. No particular tendency is shown by the disease to spread along the rows from tree to tree in a regular manner, and there is no evidence to show that the spawn of the fungus can travel sufficiently far underground to infect the roots of healthy trees in the vicinity of an unhealthy one.

If plum trees are cut back and regrafted, the disease sometimes breaks out in an epidemic manner. Thus in one group of twenty trees which were cut back and regrafted, the scions failed to grow, and shoots arising from the branches and trunk of each tree became silvered. The following autumn *Stereum purpureum* developed in abundance on each one of these trees. The large surfaces exposed when the trees were cut back had not been protected in any way, and so every facility was afforded to *Stereum purpureum* to effect an entrance.

Apple trees are not so much attacked by Silver-leaf in this country as are plums, but Gussow has pointed out that certain varieties are very susceptible to the disease in Canada. Where apple trees are affected, the course of the disease is similar to that which has been described in the case of plums. Although adult apple trees showing Silver-leaf are comparatively rare in this country, scions of regrafted trees are frequently silvered. Thus in the Cambridgeshire district, scions of Bramley's Seedling frequently become silvered when worked on old stocks, especially if the exposed surfaces of the stock are not protected. Strongly growing grafts often grow out of the malady, but it is not rare for the stock and grafts

to be killed by *Stereum purpureum* in the course of time. Fig. 5 shows a regrafted Blenheim Orange tree which has been killed by *Stereum purpureum*, the fructifications of which appear in great abundance on the stock.

The course of the disease in the apricot, cherry, red currant, &c., is similar to that in the case of plum and apple trees.

Treatment.—In regard to the treatment of the disease, efforts should be made to prevent the development of fructifications of *Stereum purpureum* in fruit plantations. This fungus should be looked upon as a dangerous enemy on whatsoever material it may develop in the vicinity of fruit trees. All dead parts of silvered trees should be cut out and destroyed; in fact, it should be the aim of fruit-growers to allow no dead wood of any description to remain in their gardens. It is useless to remove the fructifications of *Stereum purpureum* without destroying at the same time the woody tissues on which they grow, as another series of fructifications will probably develop from the spawn remaining in the wood. It is, of course, impossible to eradicate such a common fungus throughout the country, but if it is prevented from developing in fruit plantations the risk occasioned by it will be much lessened. There is no doubt that the power of wind to disseminate fungoid diseases is sometimes overrated, especially in the case of fungi, which, like *Stereum purpureum*, act as wound-parasites, so that although *Stereum purpureum* cannot be extirpated completely, good will undoubtedly be done by preventing the fungus from producing fruit bodies in the midst of fruit trees. Even in plantations that are well managed in other respects, the spore stage of this fungus is often allowed to develop with impunity. This should no longer be the case. Where Silver-leaf has appeared in a fruit plantation, experience has shown that benefit is derived by cutting out affected branches, but in order that this operation may be successful, care must be taken to cut back below the limit of discoloured wood, which, as has been pointed out above, is often a considerable distance below the silvered foliage. Where large branches are cut out the exposed surfaces should be covered with a coating of gas tar. Cases of natural recovery of trees which are slightly silvered are not infrequent, but trees that are badly silvered and beginning to

die back should be destroyed. It is courting disaster to allow such trees to remain standing until dead, and thereby afford opportunity for the production of the fruits of *Stereum purpureum*. Even when trouble is taken to remove affected trees they are often piled in the plantation for a sufficient length of time to allow of the formation of the fruit bodies of the fungus. Such a practice is almost as bad as that of allowing dead trees to remain standing. One of the first principles of plant sanitation is to prevent the accumulation of wood piles in fruit gardens.

The large amount of pruning and thinning out to which fruit trees are necessarily subjected may be indirectly responsible to some extent for the increase of the malady, and where the pruning is excessive and badly done, as is frequently the case with Victoria plums growing against walls in private gardens, Silver-leaf disease is very likely to develop. Pruning should be done carefully, and branches should be cut back as close as possible so that no snags are left. Where large branches are cut away the exposed surfaces should be coated with gas tar.

Improper grease-banding is another factor which favours the development of the disease. Where the grease has been placed directly on the tree or has soaked through the band, the bark frequently becomes rotten and torn. Such tissues offer facility for the development of *Stereum purpureum*, and, indeed, one often sees this fungus growing in such places on trees that are silvered. Both for this reason and for others well known to fruit-growers, the grease should not be placed directly on the trees, the bands should be such that the grease cannot penetrate to the bark, and their position should be altered somewhat each autumn, so that the same area of bark is not covered in successive years.

Where regrafted apple trees show silvering of the foliage they should be kept under close observation, and at the first signs of die-back they should be removed. On the other hand, if this condition is not indicated, the grafts will probably recover in the course of time. The exposed surfaces of regrafted trees should always be protected either with grafting wax or with clay.

Other kinds of treatment have been suggested for the

amelioration of silvered trees, but up to the present time none of them have been commercially successful when tried on a large scale, hence fruit-growers should direct their efforts to carrying out the measures indicated above. Recovery of small numbers of silvered trees has been reported in connection with various methods of treatment, but in most of these cases the fact that silvered trees sometimes recover without treatment is not taken into account. In view of the possibility of recovery without treatment, it is difficult to lay any stress on the results of experiments which have not been carried out on a large scale.

SOME DOUGLAS FIR PLANTATIONS.

III.—LLANDINAM PLANTATION, MONTGOMERYSHIRE.

PROF. FRASER STORY.

University College of North Wales, Bangor

THE figures set out in the following article demonstrate how great may be the volume of timber produced by a plantation of Douglas fir of moderate density. The owner of the plantation described is Mr. David Davies, M.P., who has very kindly rendered every assistance to the writer in obtaining the necessary data.

(1) *General Description of Sylvicultural Conditions.*—The plantation is about three-and-a-half acres in extent, and is situated for the most part on the left bank of a small stream, the ground sloping somewhat steeply in a south-easterly direction. Shelter is provided by rising ground to the south, but the upper part of the wood is exposed to westerly winds. The elevation is 580 ft. above sea-level. Records kept at Plas Dinam for the past thirteen years show that the mean annual rainfall is 38·07 in.

The soil is a clayey loam of a yellowish brown colour, only about 12 in. in depth, overlying Silurian Shale. On the surface is a sprinkling of Douglas fir needles, but no living vegetation. A mechanical analysis * of the upper nine inches of soil yielded the following result:—

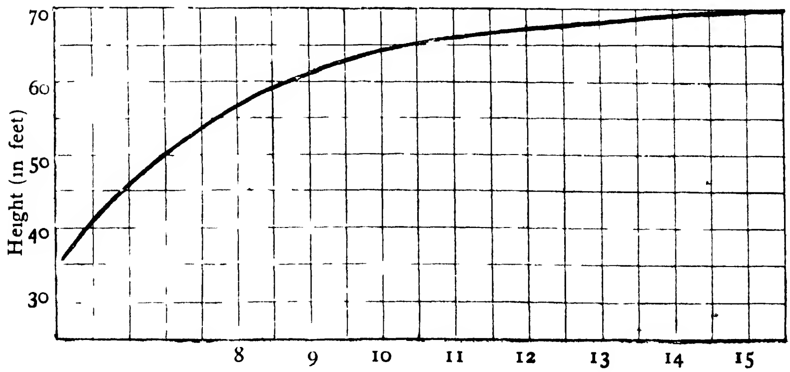
* This analysis was kindly made for the writer by Mr. G. W. Robinson, of University College, Bangor

	Diameter of Particles.	Per cent.
Fine Gravel	3—1 mm	7 55
Coarse Sand	1—0·2 mm	3 70
Fine Sand	0·2—0 05 mm	15 71
Silt	0 05—0 01 mm.	24·43
Fine Silt	0·01—0 002 mm.	22 41
Clay	below 0 002 mm	8 00
Moisture (Hygroscopic)	...	3 62
Loss on Ignition	...	9 58
Calcium Carbonate	...	—

(2) *History of Plantation.*—The plantation is twenty-eight years old. It consisted originally of mixed Douglas fir and larch, arranged in lines six feet apart, rows of pure larch alternating with rows of larch and Douglas fir. There were thus about 1,460 plants, 1,100 larches and 360 Douglas firs per acre. The Douglas firs have not been much reduced in number, but the larches finally disappeared about ten years ago.

(3) *Estimate of Volume of Timber.—Method of Measurement.*—A small area of three square chains (0 3 acre) in extent has been taken, and the trees marked out and numbered in order to allow an accurate record to be kept. In calculating the volume, the average of two diameters at breast-height (4 ft. 3 in. from the ground), measured with callipers, was taken: the heights were obtained for each diameter class, Weise's hypsometer being used, supplemented by actual tape measurements from the tops of the trees. The heights of 40 per cent. of the trees were ascertained by this method, and the curve given below was constructed from the measurements obtained.

DIAMETER-HEIGHT CURVE OF TREES IN SAMPLE AREA.



Diameter (in inches) at breast height.

The detailed measurements of the sample area are as follows:—

Diameter class (4 ft. 3 in. from ground)	Number of trees in diameter class.	Sectional area of diameter class	Average height	Product of sectional area and height
inches	No	square feet	feet	cubic feet.
6	2	0 3926	41	16 09
6½	3	0 6912	46	31 79
7	3	0 8019	50	40 09
7½	2	0·6136	54	33 13
8	4	1 3964	57	79 59
8½	2	0 7882	59	46·50
9	7	3 0926	61	188 64
9½	7	3 4461	63	217 10
10	9	4 9086	64	314 15
10½	11	6 6154	65	430 00
11	9	5 9400	66	392 04
11½	4	2 8856	67	193 33
12	9	7 0686	67	473 59
12½	7	5 9661	68	405 69
13	9	8 2962	68	564 14
13½	4	3 9764	69	274 37
14	5	5 3450	69	368 80
14½	3	3 4401	69	237 36
15	2	2 4544	70	171 80
15½	2	2 6208	70	183 45
Total ..	104	70·7398	—	4661 65

The sectional area in the above table is equivalent to 235 8 sq. ft. per acre.

The form factor was obtained from the accurate measurement of one of the trees in the plantation which closely

Number of section	Dimensions of section			Volume
	Length	Mean diameter	Sectional area	
	feet	inches	square feet	cubic feet
1	6 0	13 25	0 9576	5 7456
2	6·0	10 50	0 6014	3 6084
3	6 0	10 00	0 5454	3 2724
4	6 0	9 25	0 4668	2 8008
5	6 0	8 50	0 3941	2 3646
6	6 0	7 25	0 2867	1 7202
7	6 0	6 25	0 2130	1 2780
8	6·0	4 75	0 1231	0 7386
9	6 0	3 25	0 0576	0 3456
10	6 0	2 00	0 0218	0 1308
11	4 5	—	—	0·0082
Total ...	64 5	—	—	22·0132

approximated to the arithmetical mean of the trees in the sample area. The tree was divided into eleven sections, each of which was measured separately. The actual measurements were as given immediately above.

The diameter of three inches was reached at 52 ft. from the ground, and the volume to that point was found to be 21·8 cub. ft. At 4 ft. 3 in. from the ground the tree had a diameter of 11 in., and the sectional area at breast-height was therefore 6600 sq. ft. The total length being 64 5 ft., it follows that the stem form factor, including the top section, is ·517, or, if timber under three inches in diameter be excluded, ·512.

The volume of the 52 ft. of stem under three inches in diameter, calculated by the British quarter-girth system (over bark), is 15·25 cub. ft.

Applying the form factor of ·512 to the total product of the sectional area and height in the table above, the resulting figure for the timber (to three inches in diameter) on the sample area is 2386·76 cub. ft., which is equivalent to 7955·86 cub. ft. per acre.

If the volume of the felled sample tree is merely multiplied by the number of trees per acre, and no form factor used, the timber contents per acre would appear as 7,565 cub. ft., instead of 7,956, as given above. This difference, which amounts to about 5 per cent., is accounted for by the fact that, as is shown by the comparative table below, the sample tree is slightly below the average in basal area and height.

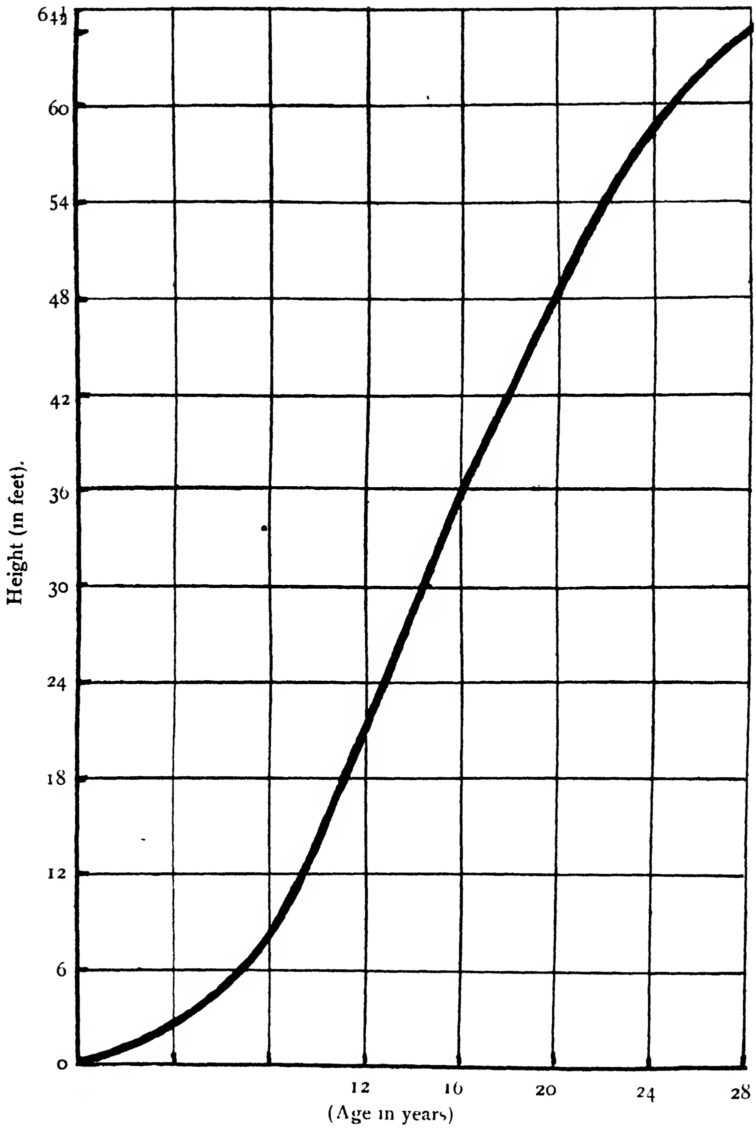
	Diameter at breast-height	Sectional area at breast-height.	Total height	True volume
	inches	square feet.	feet	cubic feet.
Sample tree .	11 0	0 6600	64 5	21 79
Average of trees in sample area . .	11 2	0 6842	66·0	23·12

The timber contents per acre, calculated by quarter-girth measurements, amount to 5,563 cub. ft.

(4) *Annual Increment.*—The mean annual increment per acre is found to be 199 cub. ft., reckoned by the quarter-girth system, and 284 cub. ft. by true measure. The height-

curve given below shows that rapid growth did not commence until about the seventh year, a fact which greatly affects the average increment in such a young plantation.

HEIGHT-GROWTH CURVE OF SAMPLE TREE.



(5) *Comparison with Taymount Plantation.**—It is interesting to compare the measurements of the Llandinam plantation

* An article on the Taymount plantation appeared in this *Journal* for August, 1913, p 402.

with those of the famous Taymount plantation at the same age of twenty-eight years. The figures are set out in the following table:—

	Average diameter	Average sectional area.	Average height	Average volume per tree	Number of trees per acre	True volume per acre.
	inches	sq ft	feet	cub ft	No	cub. ft.
Taymount	12 (At 4 ft 6 in. from ground)	0 783	60 (sample tree)	18 5	202	3738
Llandinam	11·2 (at 4 ft 3 in from ground)	0 684	66	23	347	7956

It will be observed that at Taymount the volume was rather less than half that at Llandinam. The difference is no doubt chiefly due to the number of trees per acre, the Taymount plantation having been too severely thinned in the year previous to measurement. In addition, the individual trees in the Llandinam plantation are larger, being both taller and more cylindrical.

(6) *Financial Results.*—It is evident from the figures which have been given that the plantation has proved a most profitable investment, but the monetary yield can only be approximately estimated here. The actual price procurable for the timber is not known, since none of it has been sold in the district; but its quality merits at least 6*d*. per cub. ft. quarter girth. There is no record of the original cost of formation, but it would be easy to plant a similar wood at the present time for £5 per acre. Upon this basis the capitalised expenditure per acre to date, allowing 3 per cent. compound interest, is as follows:—

		£
Cost of Formation —		
	Amount of £5 for 28 years at 3 per cent ..	11 44
Maintenance —		
	Amount of 1s. per annum	2 15
Rates and Taxes —		
	Amount of 1s per annum	2 15
	Total per acre ...	£15 74

The approximate value per acre of the present stock of timber (5,563 cub. ft. at 6*d.*) is £139, showing a net estimated return of £123. At 3 per cent. compound interest this sum is equivalent to an annual rent of £2 17*s.* an acre, while the ordinary annual rent of the land, had it remained under agricultural occupation, would have been 3*s.* 9*d.* an acre.

The writer desires to express his obligation to the Estate Agents, who have supplied him with most useful information, to the forester and woodmen, and to Mr. Thomas Thomson, his colleague at Bangor.

CULTIVATION OF TOBACCO IN GERMANY.

ATTENTION has recently been directed by the agricultural press of Germany to the decline in tobacco cultivation in that country in the last twenty years, and the following account of the methods adopted in Germany, though not necessarily applicable to English conditions, may prove of interest to British agriculturists.

The average yearly consumption of tobacco in Germany is estimated at 98,000 tons, valued at £6,500,000; over two-thirds of the total quantity used is imported, the home production in recent years averaging about 30,000 tons, of the value of about £1,500,000. The net income from the taxation of tobacco amounted to £5,000,000 in 1911.

In the period 1891–1895, the number of tobacco-growers in Germany averaged nearly 153,000, but by 1905–1910 the number had dropped to 95,000. Most of these cultivators are small farmers, relying either wholly or to a considerable extent on the crop for their livelihood. The total area under tobacco decreased from 43,000 acres in 1891–5 to 38,000 acres in 1905–10. Thus, the decline in the area has not kept pace with that in the number of tobacco-growers, so that the area of the individual holder's tobacco land has been increasing. The yield of dried tobacco for the whole country dropped from 723,000 cwt. in 1891–5 to 599,000 cwt. in 1905–10. Taking the twenty-year period as a whole, the yield per acre may be said to have remained fairly constant; it was 1880 lb. in 1891–5, 1860 lb. in 1896–1900, 1950 lb. in 1901–5, and 1780 lb. in 1905–10, but this last period seems to have been abnormal,

as during these five years both the highest (2,115 lb. per acre in 1908) and the lowest (1,553 lb. per acre in 1909) yields of the whole twenty years were obtained.

The changes in the area, yield, &c., in the twenty years are shown in the following table:

Average of five years	Number of Tobacco growers	Area under Tobacco.	Yield of Dried * Tobacco	Yield per acre
		acres	cwt	lb
1891–1895	152 690	43,000	723,000	1,880
1896–1900	136,352	45,000	743,000	1,860
1901–1905	108,606	40,000	696,000	1,950
1906–1910	95,369	38,000	599,000	1,780

* After drying in sheds into which the tobacco is taken after harvesting

According to a writer in *Fuhling's landwirtschaftliche Zeitung* (15th June, 1913) the true criterion in the discussion of the results is the value of the yield, and as prices have increased in the last twenty years a very different aspect of the case is obtained from this standpoint. The following are the values of the total and average yields per acre on the basis of the prices throughout the period:—

	Value of Total Yield	Value of Yield per acre		
	£	£	s	d
1891–1895	1,463,000	34	0	0
1896–1900	1,515,000	33	17	0
1901–1905	1,466,000	36	15	0
1906–1910	1,568 000	41	13	0

Directions as to Cultivation.—In a recently issued leaflet (*Flugblatter der deut. landw. Gesell.*, No. 15, 5th July, 1913) the German Agricultural Society emphasises the need for the very careful treatment of the crop, and a summary of the directions given may be of interest.

Seedlings.—The seed should be pure, and if possible from plants which have already done well in the district. Inferior seeds can be separated by soaking in water, when they will remain on the surface.

The grower should preferably raise the seedlings himself in garden beds, boxes, or hotbeds. In germinating the seed, rapid growth should be aimed at, a good plan being to soak the seed for some time in a small quantity of water before sowing.

The seed bed should consist of good garden soil or compost, placed over a layer of well-rotted horse manure; if used repeatedly the soil must be exposed to frost during the winter, frequently turned over, and mixed with fresh compost before seeding. The use of beds, in which it is evident that plants attacked by fungi have been grown, should be avoided.

The beds should be as large as possible, and the seeds should be sown at latest in the last weeks of March, so that for transplanting in the field the seedlings are as strong as possible, sufficient seedlings being retained to fill up gaps in the field caused by failures; 14,000 plants may be reckoned as sufficient for an acre, for which about 20 sq. yds. of seed bed and 1 1 oz. of seed will be necessary. The seed should be mixed with damp earth, sand, or ashes, then broadcasted and lightly raked in.

To keep the seed bed moist it should be sprinkled over with fine compost soil or dry horse manure and watered as necessary. Seedlings should be protected against night frosts and the direct rays of the sun by coverings of oil paper, twigs or muslin. Special care must be taken to prevent damage by weeds or fungus pests.

Cultivation in the Field.—The soil should be open, warm and light, but with sufficient humus and moisture, and should have a mild aspect in a position which is not too dry and is protected from strong winds. The land should be ploughed and manured in autumn. Cultivation in spring should not be commenced until the land is loose and workable, when it should be ploughed several times and cultivated until it is clean and free from weeds, and of the quality of garden soil.

As regards its place in the rotation, the preceding crops may be tobacco (so long as the land is not infested with tobacco fungi), potatoes, hemp, or cereals if suitably manured; clover and green manuring crops seem to injure the quality of the succeeding tobacco crop.

Well-rotted stall manure should be used, and artificials that are poor in chlorine. Fresh and liquid manure, muriate of potash, and kainit should be avoided. The potash required should be applied in the form of sulphate of potash. It is estimated that a yield per acre of 16 cwt. of leaves and

32 cwt. of stems takes away from the soil 89 lb. of nitrogen, 27 lb. of phosphoric acid, 143 lb. of potash and 108 lb. of lime. Good burning tobacco leaves should not in general contain more than 0·6 per cent. of chlorine and less than 6 per cent. of potash in the dry matter. Tobacco, therefore, needs relatively large amounts of easily soluble potash in the soil, especially after crops which remove a large quantity of potash, *e.g.*, potatoes.

Early in autumn a good dressing of stall manure should be given, and at the end of March at the latest a dressing of 180 lb. to 270 lb. per acre of sulphate of potash (the grade used contains about 52 per cent. of potash). The quantity of artificial manure varies with the nature of the soil and the amount and quality of the stall manure. In spring, shortly before planting, and according to the nitrogen and phosphoric acid content of the soil, up to 90 lb. per acre of superphosphate and small quantities of sulphate of ammonia or nitrate of lime should be given.

The seedlings should be transplanted when they have about six leaves, and if possible from the end of May until at the latest the middle of June, most suitably on a moist, cloudy day, in rows so that the plants (on good soils) are 20 × 18 in. apart, or, where a ridge plough is used, 22 × 16 in. apart. On poorer soils the plants should be set closer, and watering should not be forgotten if a period of drought sets in, or if good root growth is not made.

Attention in the Field.—The first hoeing should be given as soon as the plants are sufficiently high, and at the same time any gaps should be filled up. The hoeing should be repeated after three weeks and the earth heaped up round the plants (but not so as to cover the lowest leaves) as a protection against damage by wind. The land should be kept free from weeds, and cultivation should not be carried out while the land is wet.

The topping (removing the tops of stems with the thumb and middle finger) should be carried out as soon as the flowers begin to grow out; to obtain fine leaves, twenty leaves, or if a great weight of leaf is desired, twelve leaves, should be left on the stem. Suckering is best done at midday on dry days as soon as the side shoots are two inches long.

Special attention should be given to keeping the crop free from such pests of roots and leaves as wireworms, cockchafer grubs, snails, surface caterpillars.

Harvesting and Drying.—Harvesting should take place when bright spots appear on the leaves and the edges of the leaves begin to bend and colour yellow, *i.e.*, from the end of August until the middle of September. The grower should first break off, on dry days, the lower leaves, which are thick on the stem. About eight to twelve days after this the middle or best part of the crop should be removed, and again about one week later the uppermost leaves. Harvesting the middle and upper leaves at the same time is not recommended. The different classes of produce should be sorted out and bound with straw, or better, strips of cloth, in clean bundles, and placed in a cool, dry place. The bundles should be hung up to dry when the leaves are withered, and in such a way that air can circulate between the leaves. Care should be taken not to grow more tobacco than the drying room will accommodate. Hanging, sorting and bunching should not take place in wet or frosty weather.

Care should be taken to have sufficient ventilation when drying so that the leaves will be uniformly brightly coloured and remain sound. The first bundle should therefore be hung on the side of the drying shed opposite to the direction of the wind. When the thick middle vein is brown and no more water comes out on squeezing and the leaves feel dry, "shed" ripeness is attained.

The tobacco should be stored in a cool, airy place in long heaps on a dry layer of boards and covered with dry straw. The heaps should be turned if heating ensues, but they should not be sprinkled with water, even if the leaves feel too dry. The tobacco should be sold as soon as possible.

Cost of Cultivation.—Some idea of the net profit per acre can be obtained from a consideration of the cost of cultivation, given on the next page. This is stated to be the approximate cost in Alsace-Lorraine.

The value of the crop per acre obtained in Alsace-Lorraine in the five years 1906–10 was more than 28 per cent. higher than that for the whole country, *i.e.*, about £53 10*s*. The yield per acre was about 27 per cent. higher, *i.e.*, 2,260 lb., so

COST OF CROP.	£	s	d
Rent ...	4	0	0
Farmyard manure cost and spreading	7	0	0
Ploughing, 3 to 5 times	1	9	0
Other cultivations	2	0	0
18,000 seedlings	1	2	0
Carrying water for watering seedlings ..	0	8	0
Planting out	0	16	0
Hoeing	0	8	0
Earthing up	0	12	0
Topping ..	0	8	0
Suckering, 2 or 3 times	0	12	0
Harvesting	3	10	0
Carriage from field to drying shed	0	9	0
String	0	10	0
Storage (hire of shed)	2	10	0
Hanging	0	2	0
Tying ..	0	16	0
Agent's charges ...	0	5	0
Allowance of 1 per cent for "fair weight" .	0	5	0
Total	£27	2	0*

* In the Kent experiments in 1911, the cost was found to be £27 2*s*. 6*d*. per acre, while in Ireland in 1910 the cost was estimated at £18 13*s* 5*d* per acre

that if the above cost of cultivation be taken as an average for Alsace-Lorraine, and allowing 2¼*d*. per lb. for tax,* the net profit per acre of tobacco land in that Province would be about £5 5*s*. per acre.

A NEW GRASS PARASITE

(*Cladochytrium graminis*, Busgen.)

G. MASSEE.

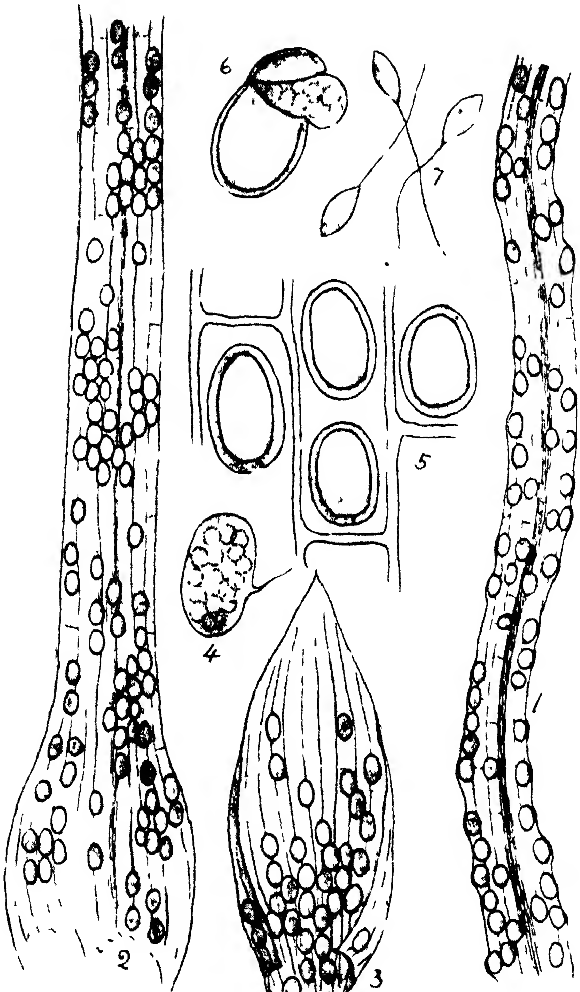
THE parasite was first observed in this country in 1908, when a sod of diseased grass was sent to Kew for determination. In connection with this it was stated that the disease had appeared in every instance where portions of a consignment of continental grass seed had been sown. The spread of the disease was checked by the removal and burning of all diseased patches, and nothing more has been heard of the parasite until the present season, when its presence has been notified at Kew from several widely separated localities in the south of England. At present the parasite has only been observed to attack species of *Festuca* and other grasses with small leaves, and is consequently most prevalent on lawns,

* The tax on home-grown tobacco leaves is from 2¼*d*. to 3*d* per lb, while the duty on imported unmanufactured tobacco leaves and stems is 4⅝*d* per lb

tennis grounds, bowling-greens, &c. The symptoms of its presence are the appearance of small, yellowish patches, a few inches across, scattered over the lawn. These patches gradually increase in size and often encroach on each other, forming large, irregularly-shaped areas which eventually become brown owing to the entire disappearance of the grass.

The fungus under consideration, like the one causing "damping off" in seedlings, belongs to a primitive type, in which the reproductive bodies called zoospores possess the power of spontaneous movement in a film of water, by which means they are enabled to migrate from their place of origin, and infest adjacent plants. This peculiarity explains the observation made by a correspondent, that the disease spreads most rapidly after a fall of rain. The root of the grass is the part first attacked. As the result of infection a very slender, branching mycelium spreads in the tissues, which gives origin to numerous thin-walled zoosporangia, from which zoospores are liberated. These in turn infect the roots of neighbouring plants; thus a single infected plant, acting as a centre of disease, may lead to the destruction of the grass extending over a large area when weather conditions favour the dispersion of the zoospores. At a later stage myriads of thick-walled resting-spores are formed in the tissues of the root and of the lower leaves that are lying on the ground. In rare instances resting-spores are also present in the flowering glumes and in the "seed" coat. This probably only happens when the inflorescence has by some means been pressed close to the ground, where the zoospores would be able to reach it. Where infected plants die the resting-spores are set free in the soil, which is invariably infected after the growth of a diseased crop. The resting-spores remain in the ground for some time in an unchanged condition, and on germination liberate zoospores, which are capable of attacking the roots of grass and causing a new outbreak of the disease.

Seed of *Poa annua* and of *Festuca ovina*, sown in soil infected by mixing with it a broken up sod of diseased grass produced diseased plants, whereas *Dactylis glomerata*, and *Triticum caninum*, sown in infected soil, remained free from disease. Control sowings of the four grasses in uninfected soil remained healthy.



A NEW GRASS PARASITE (*Cladochytrium graminis*, Busgen)

1	Resting spores in fragment of grass root	× 65
2	,, ,, ,, ,, grass leaf	× 65
3	,, ,, ,, flowering glume	× 65
4	Zoosporangium containing zoospores	× 400
5	Resting spores in cells of leaf	× 400
6	Resting spore commencing to germinate	× 400
7	Free zoospores	× 600

Microscopic examination of a sample of grass seed that had produced a diseased crop showed that only about five per cent. of the seed contained resting-spores of the fungus in the seed coat. This percentage, however, is more than sufficient to set up diseased patches at intervals in the seed-bed or lawn. These would serve as starting points from which the parasite could spread in every direction, more especially during a rainy season.

A plot of *Poa annua*, grown in infected soil, showed the presence of the disease in a few scattered plants when seven weeks old. It was found that by watering the soil with a solution of sulphate of iron—half a pound to a gallon of water—the spread of the disease was checked.

A second plot of *Poa annua*, grown in infected soil, but not treated, was killed by the parasite.

The treatment should follow a rainfall, or a thorough soaking of the ground with water, for the reason already given. It is important that the treatment should be repeated two or three times, according to circumstances, at intervals of about ten days, as free zoospores only are killed, and these are liberated at intervals.

It is very doubtful whether any known method of seed sterilisation would prove of value, as the thick-walled resting-spores are imbedded in the tissues of the seed, whereas the spores of "smut," "bunt," &c., where proper treatment proves effective, are not so thick-walled, and lie free on the surface of the seed.

Now that the disease is undoubtedly present, and perhaps to a greater extent than is realised, the most certain method for preventing its wholesale distribution turns on the selection of seed from districts free from the disease, and as the symptoms are so evident in the field, and so readily corroborated, or otherwise, in the laboratory, this should prove a comparatively easy matter.

This parasite has probably been introduced from the Continent. It is not known as an indigenous British fungus, and was first found by De Bary in Germany.

Eradication of the Ox-eye Daisy.

THE ox-eye daisy (*Chrysanthemum leucanthemum*, L.), sometimes called "dog daisy," is an erect perennial with branched stems bearing large, white, daisy-like flower-heads, which are from one to two inches across. It flowers from June to August. The fruits or "seeds" are ribbed, and are a common impurity of grass seed. This weed is most common in grass land in poor condition, especially on clays and calcareous loams; it may also occur in arable land.

The following measures may be recommended to combat the weed:—

(*a*) Pure seed, free from the "seeds" of the ox-eye, should be ensured.

(*b*) Care should be taken to destroy all refuse, seeds, and contaminated chaff, &c., from thrashing and winnowing; such rubbish should be burnt.

(*c*) The free use of well-rotted farmyard and other manure to improve the condition of the land has the effect of greatly diminishing the ox-eye daisy.

(*d*) If the weed is plentiful in grass for hay, the "seeds" are certain to be returned to the fields in farmyard manure, as well as by stock eating the hay—particularly when the hay is given to sheep in the fields. Hence:—

(*e*) Great importance must be attached to the necessity for early cutting of hay before the ox-eye ripens its seed in June, July, and August. Unless this be practised, it is probable that other measures will be useless, for each plant may produce 1,300 to 26,000 seeds. According to experiments conducted at the New Hampshire Station some years ago, the ox-eye requires at least twelve days after it blooms in which to mature its "seeds," so that they will germinate. If cutting is practised within such a period, therefore, seeding is unlikely to occur.

(*f*) The use of salt has been recommended by the United States Department of Agriculture; perhaps 6 cwt. per acre might usefully be tried on grassland in early April; it might be best to try half an acre first, and if any marked effect were observed during the summer, the rest of the area might be treated in autumn. The salt is unlikely to damage grasses permanently, though it may scorch them at first.

(*g*) On pastures where the weed abounds, depasturing with

sheep in spring and summer is useful, as sheep are known to eat the young shoots of the ox-eye and other weeds, thus preventing flowering. Cattle, however, reject the weed.

(*h*) The Canadian Department of Agriculture recommend ploughing up of infested land, and a short rotation, including seeding down to clover at short intervals, as probably the best method of clearing land of this weed. As the weed is shallow-rooted, ploughing down appears to kill it.

Although always reputed to be a weed of land in poor condition, a case came under the notice of the Board in 1911 in which land in high manurial condition was infested. The land in question was farmed by Mr. Jas. N. Forsyth, of Quinish, Tobermory, Argyllshire. The weed had been present for many years previous to 1911, but had never grown plentifully, and had confined itself to sharp, rather light loam on a gravel subsoil. In 1910 and 1911, however, it spread on to both strong loam and peaty land, with serious results. The arable land (120 acres) was worked on the following rotation:

(1) Lea oats from grass. (2) Green crop—turnips, mangolds, and potatoes (heavily manured with farmyard manure and artificials). (3) Oats with grass seed (dressed with 8 cwt. basic slag per acre). (4) Rye-grass cut for hay. (5) Second year of hay. (6) (7) and (8) Pasture.

The ox-eye daisy was not noticed in the oats from grass, the roots, or the oats with grass seed, but appeared in the rye-grass of the following year, and the second crop of hay was badly infested.

In this case (and though the weed was present years before the grass seed was sown down), "seeds" of the weed may have been introduced with the grass seed sown in the oats, and the weed would hence appear in the rye-grass a year later, and would be strongly established and flower freely by the time the second crop of hay was taken, remaining until the next ploughing.

A second possible source of infestation was the introduction of the seeds with the farmyard manure applied to the green crop, the thorough hoeing doubtless given preventing the seedlings becoming established until the oats were sown. In the lea oats the time would also probably not allow the weed to become established before the root crop was taken, and

the latter would postpone its appearance until the grass seed was sown down. "Seeds" of the weed may be distributed by the wind from field to field, and if the ox-eye sets seed freely in one field it may mean that the adjoining fields (especially the one in the direction of the prevailing wind of June to August) are infested during the next year or two.

The weed appeared to renew itself by seed only, and might probably have been kept in check by early cutting. Mr. Forsyth, however, decided to carry out an experiment to test the efficacy of salt. On April 24th, two plots, each of four-fifths of an acre in size, were taken in two fields, the first having been four years, and the second three and two years (half of each) in grass, and 5 cwt. of salt (*i.e.*, at the rate of $6\frac{1}{4}$ cwt. per acre) was sown on each. On inspection of the plots at the date of sowing, it appeared that the greater number of the ox-eye daisy plants were in vigorous leaf, about one inch or more above ground, a few having formed stems of three inches in height. On April 27th the smaller plants were blackened, and those with three-inch stems were drooping. On May 9th the whole of the smaller plants were completely killed, while those with three-inch stems had recovered. The spring of 1912 was very early, and it is probable that if the salt had been sown ten days earlier, when the plants were just above ground and before any stems had formed, there would not have been a living ox-eye on either plot. The salt did no injury to the grass, but appeared to kill the moss, in addition to the ox-eye.

On June 25th the ox-eyes that survived all appeared to be in flower, three separate pieces, each of one square yard, were measured off on each plot, and the flower stems carefully counted. The three different pieces were selected on those parts of the plots which appeared to have (*a*) least, (*b*) an average number, and (*c*) most ox eyes. On Plot 1 (rather strong land) the numbers were respectively (*a*) 12, (*b*) 27, and (*c*) 232 weed plants; and on Plot 2 (light loam on gravel) (*a*) 25, (*b*) 58, and (*c*) 149 plants. The results on untreated land were 213 stems per square yard in the case of the first field, and 184 stems in the case of the second. The large number (232) of weeds on the third square yard of Plot 1 consisted mostly of small and weak-flowered stems apparently

checked by the salt, and it was thought that these would not have matured their seed. The average number of weed stems per square yard was, therefore, placed at 27 in the case of Plot 1, and 58 in the case of Plot 2, compared with 213 and 184 from untreated parts of the fields. The estimated increase of hay was 5 cwt. per acre on Plot 1, and 2½ cwt. on Plot 2, with a considerable improvement in the quality of the hay. The cost of the salt (21*s.* a ton f.o.b. Glasgow) was increased by the freight charges (12*s.* 6*d.* a ton), and the cost of cartage and distribution (2*s.* 6*d.* a ton). Reckoning one ton of salt to three acres, the cost of the treatment worked out at 12*s.* per acre. If the hay is valued at £3 5*s.* per ton, it will be seen that there was a profit from the treatment on Plot 1, and there was a small loss on Plot 2.

The results of this experiment seem therefore to point to the conclusion that treatment with salt as soon as the weed plants begin to show above ground is quite a useful remedy against ox-eye daisy.

Subsequent observation by Mr. Forsyth has led him to express the opinion that grazing with sheep in early spring will alone lead to the eradication of this weed. On the field containing Plot 2, cut for hay this year, 15 Leicester rams were grazed until the end of April, and they ate every ox-eye shoot as fast as it came up, and there has been a further great diminution of the weed—probably due both to the salt applied in 1912 and to the sheep grazing.

The Agricultural Section of the British Association

The address delivered by Prof. T. B. Wood, as President of the Section of Agriculture of the British Association, was noticed in the last issue of the Journal. Among the noteworthy papers which were read at the meetings of the Section were the following:—

A Disease of Cereals.—Mr. W. E. Collinge read a paper on the disease of cereals, known locally as "Maysick," which takes the form of a yellowing of the foliage and stunted growth. As a result of field experiments, it was found that the disease failed to appear after the application of 6 cwt. of sulphur per acre in the autumn.

Bordeaux Mixture.—Prof. B. T. P. Barker and Mr. C. T. Gimingham contributed an account of experiments designed to throw light on the mode of action of Bordeaux mixture as a fungicide. There has been, hitherto, some difficulty in explaining how the copper present in the mixture succeeds in penetrating the tissues of a fungus. One suggestion was that the carbonic acid present in the atmosphere acted as a solvent and vehicle of attack; it now appears that the cell walls of fungal hyphæ exercise a direct solvent action on the copper, and are killed by absorbing the metal.

Barley Production.—At a joint meeting with the Section of Botany, a number of papers were read on the subject of the relative productivity of different varieties of barley. The principal paper was contributed by the well-known authority on barley problems—Mr. E. S. Beaven, of Warminster—who described a method by which it is possible to obtain a trustworthy measure of productivity in a single season. Briefly, the method consists in multiplying the experimental plots in such a fashion as to eliminate, on the average, all variations due to small differences in soil, and to proximity of other plants. The plots used are very small, and the varieties under test are grown side by side and intermingled, so that the whole experiment may be said to resemble a chessboard. The result is that the probable error of the mean of a number of plots, when expressed as a percentage of the mean, is so small that the figures for a single season may be safely used as a conclusive test of the relative productivity of the varieties under observation.

In Mr. Beaven's opinion, the best measure of the productivity of a variety is the ratio between the weight of the ears and the total weight of the plant. In other words, he believes that the differences between varieties in total weight per unit area are insignificant compared with the inherent (and hereditable) variations in the extent to which reserve material is transferred from the body tissues to the grain.

Mr. J. H. Bennett, Dr. F. E. Hachett, and Mr. H. Hunter contributed papers on variety trials with barleys in Ireland. Mr. Beaven's "chessboard" method, referred to above, was adopted for this work with conspicuous success.

Breeding Experiments.—Major C. C. Hurst contributed

notes on experiments undertaken under his supervision at the Burbage Experiment Station. Interesting results bearing on the heredity of the homing instinct of pigeons, and on various points connected with the value of eggs have been obtained. A reference was also made to the experiment in hunter breeding, which is being carried on at Burbage with the co-operation of the Board of Agriculture.

Sewage as a Manure.—An interesting and suggestive paper on this subject was read by Dr. J. Grossmann, in which he gave details of a process invented by him and now in operation at Oldham, in Lancashire. Hitherto, sewage, when used in farming practice, has failed to give the results that its chemical composition would justify. The presence of fatty substances is one great obstacle to the use of sewage as a manure, for they tend to make the soil impervious to air and moisture, and prevent the access to the plant of the valuable manurial constituents of the sludge. Dr. Grossmann's process is directed to separating the fatty matters by the action of acid and steam. The residue is a dry, inodorous powder containing a good percentage of nitrogen and phosphoric acid, besides some potash--all ingredients of high manurial value. Dr. Grossmann was of opinion that, in view of the immense and growing importance of the question of sewage disposal, experiments on a large scale should be undertaken at the expense of the Government, in order to devise a satisfactory and economical means of dealing with the sewage of large towns in a manner which would benefit public health as well as agriculture.

Physiology of Reproduction.—At a joint meeting with the Section of Physiology, papers were contributed on the practical and scientific aspects of this subject by Mr. K. J. J. Mackenzie and Dr. L. Doncaster. The former dealt with the economic waste which results from the prevalence of sterility in cows, and expressed the belief that the cause was to be sought in errors of feeding. Dr. Doncaster dealt with the physiology of sex determination, and suggested that all individuals both of animals and plants are potential hermaphrodites, the determination of sex being due to the alternative presence or absence of a Mendelian factor.

The Inclosure and Regulation of Commons.

A SELECT COMMITTEE was appointed by the House of Commons on June 6th, 1912, to inquire into the existing requirements of the law as to the procedure prescribed in connection with the inclosure and regulation of commons, and to report whether any alterations are desirable.

Regulation of Commons.—In their recently issued Report (H.C. 512 & 85 of 1913, price 1*s.* 5*d.*), the Committee assumed that the area of common or waste lands still remaining uninclosed in England and Wales approaches 2,000,000 acres. The adoption of the existing procedure for regulating commons is by no means universal, as is evident from the fact that only 48,373 acres are regulated under the Commons Act, 1876, the Commons Act, 1899, and the Metropolitan Commons Acts, 1866 to 1898. The Committee recommended that a new Act of Parliament should be passed, complete in itself, containing procedure for regulation, and rendering this procedure easier, cheaper, and more expeditious than under existing Acts.

The opinion of the Committee as to the benefits arising from regulation, as distinguished from inclosure, were based on the following considerations:—

(1) In dry seasons numerous fires occur on commons. There is reason to believe that many of these have purposely been ignited by the smaller commoners with the object of preventing the growth of fir trees and other scrub, which, if allowed to spread over the common would destroy the pasturage. Others have been caused accidentally or mischievously. But whatever the cause, enormous damage often results, as it is nobody's business to guard against fires.

(2) Gipsies or other nomads are a frequent cause of complaint. They are insanitary in their habits, spread disease, are found breaking fences for firewood, and are guilty of petty pilferings. They leave filth and rubbish on the common after their departure. Gipsies have no legal right to camp on a common; it is doubtful whether the owner has any legal right to give them permission to remain there, and there are often difficulties in removing them.

(3) Refuse is often deposited on commons, and it is not

the duty of anyone to prevent this or to remove it if it becomes a nuisance to the neighbourhood.

(4) Another difficulty has arisen in recent years from the increased use of commons for playing golf. In point of law the owner has no right to interfere with the commoners' rights by making golf courses and warning off the commoners and their cattle. There is no reason why the use of commons for golf or other games should not be permitted under regulation schemes containing proper safeguards of the commoners' rights.

(5) On commons where the pasturage rights are very valuable, disputes between commoners are frequent. They arise from the fact that some try to put on the common more stock than they are entitled to, that some put stock on the best part of the common and "dog" the others off, while others use the common who are alleged not to be entitled to common rights.

(6) On commons of another character, bracken, heath, and turf are sometimes taken by those who are alleged not to be entitled to common rights.

(7) On many commons a moderate sum spent on drainage would greatly improve the pasturage, but with respect to an unregulated common there are no means of raising a rate for this or any other purpose.

(8) The spread of seedling firs already referred to, particularly on Surrey commons, has much reduced the pasturage. There is no process of law which enables the commoners to prevent the natural growth of trees to an undue extent.

(9) Regulation, further, would prevent illegal inclosures or encroachments.

(10) All difficulties are done away with under regulation. On the other hand, no existing right is prejudiced. The rights of the lord of the manor, or other owner of the soil, to the minerals, to the timber and to the game are preserved. The rights of the commoners, which are very varied in character, are preserved, and in most cases made more valuable. The use of the common by the public is regulated for the benefit of the public, and in a manner calculated to prevent injury to the owner and the commoners.

It was further recommended by the Committee that the

proposed new Act containing procedure for regulation should contain the following provisions:—

(*a*) No change should be permitted in the legal estate of any interested party.

(*b*) The method of applying for regulation should be simplified. The lord of the manor or other owner of the soil, one-third of the commoners, the local authority (the Parish, District, or County Council), or any twelve ratepayers in the district in which the common or part of the common lies, should each have the power to apply to the Board of Agriculture for a scheme of regulation.

(*c*) The procedure of the Act of 1899 should be adopted with the necessary modifications.

(*d*) The absolute veto of any person or group of persons upon a scheme of regulation should be abolished.

(*e*) Where agreement between interested parties, including the local authorities, can be arrived at, recourse should not be had to Parliament.

(*f*) Where no agreement can be arrived at, the usual procedure of a Provisional Order Bill should be adopted with the modification that the Select Committee on Commons should be substituted for the Provisional Order Bill Committee.

(*g*) Increased regard should be given to the rights or privileges of the "labouring poor," and to the rights exercised by the neighbouring public over commons which are not part of manors.

(*h*) Where no one can prove a title to a village green, this should be vested in the Parish Council.

(*i*) The present provisions as to the confirmation of bye-laws should be altered.

Inclosure of Commons.—The Committee recommended that the procedure for inclosure should substantially be left to be dealt with by the machinery of the present Acts, viz., the Inclosure Acts, 1845 to 1899; but perhaps with some amendment of the provisions as to application for inclosure by one-third in value of persons interested, as to assets of two-thirds in value of the persons interested, and as to the veto of the lord in the case of waste of a manor, and as to reference to a Select Committee under Section 12 (11) of the Act of 1876.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURING.

The Effect of Bastard Trenching on the Soil and on Plant Growth (*Jour. of Agric. Sci., October, 1913; S. U. Pickering, M.A., F.R.S., and E. J. Russell, D.Sc., Rothamsted Expt. Sta.*).—Bastard trenching as ordinarily performed consists of two distinct operations, viz., (*a*) loosening the lower spit of soil, and (*b*) digging into it farmyard manure or other fertilising material. In the experiments described in this paper the first and second spits of soil were removed, the third spit was broken up but not removed, and then the second and first spits were replaced in their natural order. The cultivation and surface manuring of the trenched and untrenched plots were similar. The experiments extended from March, 1909, to the end of 1912, a period during which extreme conditions of temperature and moisture were experienced. Four distinct soils were investigated: a light sand, two loams, and a strong clay. The results of the experiments showed that bastard trenching *when unaccompanied by manuring* has very little effect on the soil. The main use of bastard trenching in the absence of a "pan" seems to be that it allows of manure or other fertilising material being added to the bottom spit.

Comparative Results with different Phosphatic Manures (*Northumberland County Educ. Com., Guide to Agric. Expt. Sta., Cockle Park, 1913*).—A test of the relative values of phosphatic manures was commenced in November, 1911, when plots $\frac{1}{20}$th acre in area were laid down on young three years' "seeds" after barley. The dressings, each of which supplied 200 lb. of phosphoric acid per acre, and the yield of hay in 1912 were as follows:—

	Weight of Hay, 1912 cwt.
Plot 1.—9½ cwt. basic slag, 41.3 % phosphate of lime, 89 % citric soluble, fineness 90 %, supplying 458 lb. lime per acre ...	35¼
Plot 2.—19.7 cwt. basic slag, 19.82 % phosphate of lime, 66 % citric soluble, fineness 95 %, supplying 892 lb. lime per acre ...	39¼
Plot 3.—8½ cwt. bone meal, 46.64 % phosphate of lime, mostly citric soluble; 4·78 % nitrogen; supplying 269 lb. lime per acre ...	33¾
Plot 4.—No dressing ...	33¾
Plot 5.—8.6 cwt. Tunisian rock phosphate (ground), 45.3 % phosphate of lime (trace citric soluble), fineness 100 %, supplying 426 lb. lime per acre	35¼
Plot 6.—8¼ cwt. Belgian rock phosphate (ground), 47·2 % phosphate of lime (trace citric soluble), fineness 98 %, supplying 453 lb. lime per acre	35¼
Plot 7.—16¼ cwt. Belgian rock phosphate (calcined), 24 % phosphate of lime (trace citric soluble), fineness 100 %, supplying 1,114 lb. lime per acre ...	38½
Plot 8.—4⅛ cwt. Belgian rock phosphate (ground), 47·2 % phosphate of lime and 6½ cwt. superphosphate, 29·9 % soluble phosphate of lime (100 lb. phosphoric acid) ...	37¾

* A Summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

It will be seen that the slag applied to Plot 2, which was only of 66 per cent citric solubility, has so far given a larger return than the 89 per cent. citric soluble slag applied to Plot 1 The results indicate that a high citric soluble slag is not necessarily quicker in its action than one of low citric solubility, and that a high content of lime in slags is advantageous It is stated that a high-grade slag of normal citric solubility, as a rule, costs less per unit of phosphate of lime, and on the whole has given the best economic returns. Mineral phosphates appear to be deserving of more attention from the experimenter and farmer Their cost per unit of phosphate of lime is now considerably less than that of basic slag. It is concluded that for three years' seeds there are indications that the same amount of phosphate applied in the form of a mixture of basic slag and superphosphate may give better results than when all the phosphate is applied in the form of slag.

Effect of Various Lime Dressings on Three Years' Seeds Mixture (*Northumberland County Educ Com , Guide to Agric. Expt Sta , Cockle Park,* 1913)—An experiment designed to test the effect of different forms of lime on young seeds was commenced in December, 1909 There were two series of plots, one on heavy soil, the other on light soil Both soils received 10 cwt of slag per acre, while the light soil received in addition 2 cwt of muriate of potash per acre. The following table gives the dressings and average annual yield of hay per acre —

Plot	Dressings per acre	Yield of Hay per acre	
		Heavy Soil Average for 1910–12	Light Soil Average for 1910–11
		cwt	cwt
1	10 cwt ordinary lime ...	43½	24¼
2	10 cwt ground lime .	44¾	24[illegible]
3	5 cwt ground lime	42	24½
4	11¼ cwt lime mud	41¾	25½
5	22½ cwt lime mud	44¼	23½
6	2½ cwt gypsum	51½	25
7	Untreated .	43	23½

Manuring of Beans (*Northumberland County Educ. Com , Guide to Agric. Expt. Sta., Cockle Park,* 1913)—From experiments conducted in 1906, 1907, and 1910, it was found (1) that basic slag gave better results than superphosphate, (2) that when muriate of potash was added to slag the yield of grain was increased on the average by seven bushels per acre, (3) that lime mud added to superphosphate considerably increased the crop. The trials also showed that beans should be harvested when they are still green, and when the beans in the pod become black at the hilum.

Manuring of Meadow Hay (*Grass Manuring Experiments at Kineton, Warwickshire; Report for* 1913; *Mr. Ernest Parke and Dr. B. Dyer*)—In 1901 two fields, viz , "Five and Three Acres," and "Upper Hale Field," which had been down in grass for ten years, were selected for

these experiments. The soil in both cases is a heavy clay loam, originally very poor in available phosphate

The plans of the experiments, together with the yields of hay in 1913, and the average results for the twelve seasons, are given below, the following being the figures for "Five and Three Acres":—

Plot	Annual manuring (since 1905) per acre.	Weight of Hay, 1913	Average weight of Hay in 12 years
		cwt	cwt
1	No manure	12	11
2	3 cwt. Superphosphate	28	30½
3	{ 3 cwt Superphosphate 1 cwt Sulphate of Potash }	28	31½
4	{ 3 cwt Superphosphate 1½ cwt Nitrate of Soda }	36½	39
5	{ 3 cwt Superphosphate 1½ cwt Nitrate of Soda 1 cwt Sulphate of Potash }	37½	40
6	1½ cwt Nitrate of Soda	18½	28½

In "Upper Hale Field," which is poor in lime compared with the other, basic slag was used in place of superphosphate, and the results were as follows —

Plot	Annual manuring (since 1905) per acre	Weight of Hay, 1913	Average weight of Hay in 12 years
		cwt	cwt
1	No manure ...	13½	13
2	5 cwt Basic Slag	29½	33½
3	{ 5 cwt Basic Slag . 1 cwt Sulphate of Potash. }	30	35½
4	{ 5 cwt Basic Slag 1½ cwt Nitrate of Soda }	40	42½
5	{ 5 cwt Basic Slag 1½ cwt Nitrate of Soda 1 cwt Sulphate of Potash }	40	43
6	1½ cwt Nitrate of Soda ..	20½	32½

The best herbage, consisting of a mixture of clovers and grasses, is found on the plots which have received both phosphate and nitrate each year.

Calcium Cyanamide and Nitrate of Lime (*Die landw. Versuchs-Stat., Heft i. u ii., Band. lxxxiii., B Tacke and F. Brune*).—These experiments, carried out from 1904 onwards on sandy and moor (*Hochmoor*) soils, are summarised as follows:—

Nitrate of lime has about the same value as calcium cyanamide on sandy soils, but only about 81 per cent of its value on moor soils.

To obtain the best results with calcium cyanamide on sandy and moor soils the following points should be borne in mind:—

(*a*) The calcium cyanamide should not be applied at the time of seeding, as the germination capacity of the seeds is liable to be injured thereby. The seeds of oats seem to be most susceptible in this respect. When the calcium cyanamide was harrowed in with the seeds of oats the increased yields from the manure were less than one-half those obtained with nitrate of soda

(*b*) As a top-dressing calcium cyanamide did not give its best results The increased yields from top-dressings of calcium cyanamide were only about 66 per cent of those from nitrate of soda on sandy and moor soils in the case of rye, and about 80 per cent. in the case of oats and potatoes

(*c*) The best results were obtained when calcium cyanamide was applied some time before seeding. Given thus on sandy soils its effect, on the average of all crops, was about 89 per cent of the effect of nitrate of soda. When the calcium cyanamide was applied at least eight days before seeding and carefully harrowed in immediately no harm to germination could be observed

(*d*) Placing the utilisation of the nitrogen in the manure by the plants in the case of nitrate of soda at 100, the utilisation of the nitrogen on the average of all experiments in the case of calcium cyanamide was 54 for sandy soils and 67 for moor soils

The experiments as a whole demonstrated the value of calcium cyanamide for sandy and moor soils, but in view of its inferiority to nitrate of soda farmers are not advised to purchase the manure unless it can be obtained at a correspondingly cheaper price per unit of nitrogen.

FIELD CROPS

Mixtures of Grass and Clover Seeds (*Northumberland County Educ Com, Guide to Agric Expt Sta, Cockle Park*, 1913) —In the spring of 1911 seed mixtures for one year were sown with barley on plots half an acre in area The following table gives the cost of each kind of seed used, the composition and cost of the mixtures, together with the yield of hay from each plot:—

	Cost of seed per lb 1911	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
	s d	lb	lb	lb	lb	lb
Annual ryegrass .	0 2½	24	24	18	18	—
Italian ryegrass . .	0 3	—	—	—	—	6
Perennial ryegrass	0 2½	—	—	—	—	12
English red clover ..	0 9	6	—	6	2	8¾
Swedish red clover .	?	—	6	—	—	—
Wild white clover . .	2 10	2	2	2	3	—
Trefoil ..	0 8½	—	—	—	2¾	2¾
Alsike	0 9	—	—	—	1¾	1¾
Cost of seeds per acre, 1911 ...	—	*s d* 15 2	?	*s d* 13 11	*s d* 17 0	*s d* 13 10
Weight of hay per acre, 1912 ..	—	cwt 37¾	cwt 38½	cwt. 38	cwt. 46	cwt 39½

The inclusion of wild white clover in mixtures for one year's seeds has given good results at Cockle Park Not only has an excellent and close clover aftermath been produced, but the succeeding corn crop has been greatly benefited.

In the spring of 1906 quarter-acre plots were sown down on wheat after summer fallow with four seeds mixtures, the object being to determine which one would be most suitable for laying down poor thin clay soil to pasture The following table gives the cost of each kind of seed used, the composition and price of each mixture, and the average annual yield per acre from each plot during the years 1907–12 .—

	Cost of seed per lb.	Plot 1.	Plot 2	Plot 3	Plot 4
	s. *d.*	lb	lb	lb	lb
Perennial ryegrass	0 2⅔	6	6	—	—
Italian ryegrass . . .	0 3½	6	6	6	—
Cocksfoot .. .	0 9	6	6	22	12
Timothy . . .	0 3½	3	3	—	3
Meadow fescue ...	0 11	8	8	—	6
Tall fescue .	1 0	—	—	—	4
Tall oat grass	0 8	—	—	—	4
English red clover	0 8¾	4	4	—	4
Alsike ..	0 9½	2	2	—	—
White clover	0 8	4	4	—	—
Wild white clover	1 6	—	4	-	4
		39	43	28	37
		s *d*	*s* *d*	*s* *d*	*s* *d.*
Cost of seeds per acre	—	23 0	29 0	18 3	31 0
		cwt	cwt.	cwt	cwt
Average weight of hay per acre	—	19½	30	11½	26

Wild white clover has been found to be the most valuable plant in the seeds mixtures, and cocksfoot has done best when associated with it The seeds mixture on Plot 2 has been most profitable, and would have been even more so had common white clover and meadow fescue been omitted.

Varieties of Wheat (*Norfolk Agric. Sta., Little Snoring Guide to Expts*, 1912–13)—Variety tests with wheat during the years 1909–13 appear to indicate that Little Joss, possibly Dreadnought, Sensation, Square Head's Master, Borwick, and Standard Red are the most consistent yielders of the fourteen varieties experimented with.

The Stooling Character of Oats (*Ontario Agric. Coll Report*, 1912).—While the stooling of cereals is influenced by soil fertility, weather conditions, and rate of seeding, it is also influenced by the variety. In order to obtain some definite information as to the relative stooling powers of different varieties of oats, an experiment was carried out during four seasons The seed of eleven varieties was sown in rows 1 ft. apart, the distance between the plants in the rows being also 1 ft.

The following table gives the average number of stools per plant in the case of five varieties :—

Varieties.	Average number of Stools per plant (4 years).
Abundance (Regenerated)	17
American Banner	14
Siberian	12
Storm King	8
Tartar King .	7

LIVE STOCK AND FEEDING STUFFS

Digestibility Experiments with Sheep, Para Rubber Seed Cake (*Jour. of Agric. Sci., Oct., 1913, Dr. S. J. M. Auld, Univ. Coll., Reading*).—After pointing out the desirability of carrying out digestibility trials with home-grown foods, new feeding materials obtained from the Colonies and India, and the many proprietary foods which are much used in this country, in order that tables might be constructed, which would materially assist in the calculation of rations, the author describes experiments conducted at Wye College in which three sheep (Kents) were fed as follows:—(1) seven days basal ration of 300 grammes chaffed hay and 150 grammes linseed cake, fed thrice daily without collecting fæces, (2) the same, fæces being collected; (3) eight days experimental ration (basal ration plus 150 grammes Para cake), (4) the same, fæces being collected. Analyses of Para rubber seed cake, basal ration products, fæces from basal and experimental rations are given. The figures obtained show the Para cake to be one of the most digestible concentrated foods available. This is no doubt partly due to the small amount of crude fibre present, viz., 3·15 per cent.

Cyanogenesis under Digestive Conditions (*Jour. of Agric. Sci., Oct., 1913, Dr. S. J. M. Auld, Univ. Coll., Reading*).—The considerable amount of attention paid during recent years to the liberation of hydrocyanic acid from plant products has caused grave suspicion to be cast upon certain of the latter. Of the food-stuffs which produce hydrocyanic acid in considerable quantity on maceration with water, the most important are linseed and linseed cake, Java beans and other varieties of *Phaseolus lunatus*, and immature great millet (*Sorghum vulgare*). In all cases of prussic-acid-forming feeding stuffs so far examined the hydrocyanic acid is liberated by the hydrolysis of a glucoside by a co-existent enzyme, when the ground plant or seed is placed in water. When thus treated linseed cakes produce amounts of hydrocyanic acid varying from 0·001 per cent. to 0·052 per cent. unless the enzyme has been destroyed. Investigation has shown that the liberation of hydrocyanic acid is checked to a great extent by the conditions prevailing in the digestive tract. Acidity, alkalinity, and the digestive enzymes all have this retarding influence, other inhibitory agents being salt, glucose, molasses, and cellulose.

Germination Test of Unground Grain Screenings after Digestion (*The Maryland Agric. Expt. Sta., Bull. No. 168*).—A cow and a horse were each fed 2 lb. of unground grain screenings with middlings, bran, and wheat straw each morning and night for seven days. On the evening of the seventh day they were bedded with sawdust and the dung of one

night collected. The sawdust and dung were thoroughly mixed and put in boxes in a greenhouse. The following weeds appeared —

Cow's Dung.	*Horse Dung*
149 Lamb's quarters	1,213 Lamb's quarters
12 Pig-weeds	11 Pig-weeds
14 Bind-weed	12 Bind-weed
4 Foxtail	28 Foxtail
2 Timothy	6 Timothy
	3 Clover
	5 Mustard
	2 Morning glory

These results show that more weed seeds are destroyed by passing through the digestive system of a cow than of a horse.

DAIRYING.

Chemical Changes Produced in Cows' Milk by Pasteurisation (*U.S. Dept of Agric., Bureau of Animal Industry, Bull.* 166, *Philip Rupp, M D, Ph D.*) —The objects of the work described in this bulletin were to study the chemical changes produced by the heating of milk at the different temperatures used in commercial pasteurisation, and to determine whether a temperature that destroys all pathogenic germs can be used in pasteurisation without having any appreciable effect on the chemical composition of the milk.

The results of the experiments showed that milk pasteurised by the holder process at 62 8° C (145° F) for 30 minutes did not undergo any appreciable chemical change At 68 3° C. (155° F.) the quantity of phosphoric acid, lime, and magnesia in the serum of both raw and pasteurised milk were practically the same. The albumin did not coagulate at 62 8° C (145° F), but with increase in temperature the amount rendered insoluble varied from 5 75 per cent of the albumin at 65 6° C (150° F) to 30 78 per cent at 71 1° C (160° F) The time required for coagulating the casein by rennet was slightly less in milk pasteurised at temperatures up to 65° C. (149° F) than it was in raw milk At 70° C (158° F), however, there was a slight retardation, while at 75° C (167° F) the time required was almost doubled The acidity as determined by titration was slightly diminished by pasteurisation

The Importance of Infectious Catarrh of the Vagina in the Control of Milk (*Zeitschrift fur Fleisch- und Milchhygiene, Year xxiii, Part* 5, 1912; *Messner and Kohn, Bull of Agric. Intell, Jan.,* 1913) —Variations in the composition and nature of milk are caused not only by diseases affecting the lacteal glands themselves, but also by the diseases usually accompanied by high fever which attack milch cows In epidemics of these diseases, milk control entails not only taking measures to protect human beings and animals from infection, but ascertaining whether the normal physical and chemical composition of the milk has suffered in any way The writers of this communication examined the milk of cows suffering from infectious catarrh of the vagina, and also that of healthy cows inhabiting the infected shed.

The milk of 105 cows in 29 sheds was investigated; 40 of these animals were healthy, 65 diseased, 56 had chronic catarrh of the vagina, but only 9 had the disease in the acute form The following is

the comparison of the averages obtained from the examination of the milk from 9 cows suffering from the acute form of the disease, and from 8 healthy animals, all of which were at the same stage of the lactation period :—

	Healthy.	Diseased.	Difference.
Total milk yield ...	2·53	1·80	−0·73
Specific gravity ...	1·0330	1·0312	−0·0018
Fat content ...	3·5	4·3	+0·8
Solids not fat ...	9·21	8·90	−0·31
Refractive index ...	40·2	39·4	−0·8

The following is a summary of the facts :—

(1) The milk of cows suffering from infectious catarrh of the vagina shows on an average a decrease in specific gravity and in solids-not-fat, and a lower refractive index, but the fat content is increased.

(2) The milk would therefore be passed as excellent in quality unless the data obtained by its examination were compared with those referring to the product of healthy cows.

(3) It appears from the data obtained that a change in the methods hitherto adopted for milk control in Germany is not necessary if all the characters of the milk are considered together.

POULTRY

The Utility Poultry Club's Twelve Months' Laying Competition.— The Board have received the report for the thirteenth and final period of four weeks of this competition, which terminated on October 14th. The report gives the first twenty pens in the following order of merit :—

Order.	No. of Pen	Breed.	Total Eggs for 52 weeks	Total Money Value.
1	60	White Wyandottes	1,389	7 0 3½
2	86	Buff Rocks	1,207	6 7 2
3	32	White Wyandottes .	1,276	6 5 9
4	29	" "	1,251	5 18 8½
5	35	" "	1,123	5 9 3¾
6	45	" "	1,101	5 8 11¼
7	11	White Leghorns	1,142	5 8 2¾
8	24	Black Leghorns	1,077	5 6 4¼
9	22	White Leghorns ..	1,089	5 6 0½
10	53	White Wyandottes	1,139	5 5 1¼
11	52	" "	1,093	5 4 3¾
12	54	" "	1,077	5 1 7
13	20	White Leghorns	1,039	5 0 4¼
14	95	Rhode Island Reds .	1,077	5 0 3¾
15	7	White Leghorns .	1,032	5 0 3
16	80	Buff Orpingtons .	1,009	4 19 8¾
17	10	White Leghorns ...	997	4 19 8¾
18	40	White Wyandottes	1,000	4 19 3¼
19	31	" " ..	1,005	4 17 3¾
20	49	" " ..	1,039	4 17 3¼

NOTES ON AGRICULTURAL CO-OPERATION.

Pig Insurance Clubs in 1912.

Registered Societies.—At the end of 1912 there were in operation thirty-three pig insurance societies registered under the Friendly Societies Act—an increase of one as compared with the previous year. Full statistics have not been obtained for two of these societies, so that the totals given below relate to the working of thirty-one societies. The total number of members of these thirty-one societies was 1,461, an average of forty-seven members per society The number of pigs insured was 3,066, so that the average number of pigs insured per society was ninety-nine, and per member 2 1. One society insured only twenty-two pigs, and another as many as 391. The number of pigs on which claims were paid during the year was 148, giving a death-rate of 4 8 per cent of the number of pigs insured, the same death-rate as in 1911 The amount paid on claims, after deducting income from the sale of carcasses, was £285, while the income from insurance contributions was only £239; but the total income of the insurance fund was £385 and the total expenditure £375, so that there was a gain of £10 on the working of the year, and the amount accumulated in the respective insurance funds of these societies rose from £1,884 at the beginning of the year to £1,894 at the end, an average of more than 12*s* per pig insured, and as this equals more than six times the loss per pig insured that became payable during the year, it seems on the whole to be a very satisfactory reserve, securing the members to a large extent from the risk of having to make special levies to meet exceptional losses A detailed account of the working of these societies was given in this *Journal* for November, 1912, and need not be repeated here, but as statistics for the working of registered pig insurance societies have now been collected for the last two years, it is instructive to put the figures together and see what the average experience is

The Death-Rate.

The most important question is that of the death-rate, using the term with reference to the number of pigs on which these societies have to pay insurance claims, that is, the number of animals which died or had to be slaughtered in consequence of disease or accident

Year	No. of Societies reporting.	No. of Pigs insured.	No. of Pigs on which claims were paid.	Average death-rate per cent per annum
1910	25	2,560	102	4 0
1911	32	3,570	173	4·8
1912	31	3,066	148	4·8
Average	29	3,065	141	4 6

Putting together the experience of the three years, the average death-rate for these societies has been 4·6 per cent. per annum.

Amount Payable Per Pig.

Last year, on 148 pigs that died, the amount paid by societies was £331; deducting from this the £46 received from sale of carcasses, the net loss to the societies was £285, which gives an average of £1 19*s*. per pig that died, and of 1*s*. 10*d*. per pig insured. Here, again, the experience of the last two years is as follows:—

Year	No. of Pigs insured	No. of Pigs that died.	Amount paid on claims	Receipts from sale of Carcasses	Net loss	Average per pig that died	Average per Pig insured
			£	£	£	£ s.	s. d.
1911	3,570	173	359	53	306	1 15	1 9
1912	3,066	148	331	46	285	1 19	1 10
Average	3,318	160	345	50	295	1 17	1 9

From the experience of these two years it appears that a society may expect to have to pay on the average £1 17*s*. per pig that dies, and that to cover the losses under the present rules and practice a net premium income of 1*s*. 9*d*. per pig insured would be required.

Amount of Premium Paid.

The experience of the last two years has been as follows:—

Year	No. of Pigs insured	Amount of insurance contributions received.	Average per pig insured
		£	s. d.
1911 . . .	3,570	351	2 0
1912 .	3,066	239	1 7
Average . .	3,318	295	1 9

Last year the amount of insurance contributions received fell considerably short of the net loss to the societies; but besides the insurance contributions of £239 6*s*., and the receipts from sale of carcasses £46 9*s*., the insurance funds received in entrance fees and fines £21 12*s*., in donations from honorary members £16, and in interest on their reserves £42 13*s*., besides other income, making the total income of the insurance funds £385, whereas the expenditure of these funds included other charges, besides the £331 11*s*. paid to members, and amounted altogether to £375 8*s*.; so that, as already said, the income of the year exceeded the expenditure by £10.

Reserve Funds.

During the year only one society had to make a levy of £3 11*s*.

on its members to meet insurance losses, other societies being able to show a balance to the credit of the Insurance Fund, in some cases very substantial. The society having the largest balance is that at Kemerton, in Gloucestershire, which has £176 in the Savings Bank, but six other societies had balances exceeding £100 each.

Management Expenses and Total Assets.

In the case of twenty-one societies, a separate account was kept of the income and expenditure of the management fund, and in the case of these societies the expenditure amounted to £86 3*s.* in the course of last year, including £33 9*s* for salaries As those societies altogether insured 2,308 pigs, the average expenditure per pig insured was 9*d*, as compared with 7½*d.* in the previous year

The total assets of these thirty-one societies amounted to £1,941, of which £1,795 was deposited in the Savings Bank

Unregistered Pig Clubs

Some statistics have now been collected for 832 of the unregistered pig clubs. It appears that there are no co-operative societies for the insurance of pigs in Ireland, Scotland, or Wales, or in fourteen counties of England The 832 societies for which these statistics are available are scattered through twenty-three counties, and half of them are in the two counties of Lincolnshire and Nottinghamshire, so that there is plenty of room for the extension of the system throughout the country

In 1911 these 832 societies consisted of 30,529 members, an average of thirty-seven members per society. They insured altogether 53,981 pigs, an average of sixty-five pigs per society. Of these pigs 2,837 died during the year, so that the average death-rate was 5 3 per cent The amount paid in claims was £4,968, which gives an average of £1 15*s* per pig that died and of 1*s* 10*d* per pig insured. The amount received in insurance contributions was £7,462, an average of 2*s.* 9*d.* per pig insured. These societies had altogether at the credit of their insurance funds at the end of the year no less than £27,748, an average of more than 10*s.* per pig insured, so that on the whole they are evidently in a satisfactory financial position. As compared with the registered pig societies, they are generally smaller in size and have a somewhat higher death-rate—5 3 per cent., as compared with 4 8 per cent. for the same year. The average amount of loss in proportion to the number of pigs insured is, however, much the same in both cases, and probably the reason why the average insurance contribution is so much higher in the case of the unregistered clubs than of the registered societies, is that in the former case it includes a charge for management expenses, which is separately provided for by most of the registered societies.

Model Rules.

Putting together all this experience of existing clubs, it would appear that a society in normal conditions would find it safe to insure its members' pigs at a rate of insurance contribution of 2*s.* per store pig per annum, and of 1*s.* per pig per annum for management expenses, and might expect with these rates to meet all losses and gradually to build up a reserve fund, which would enable it after some years to

reduce the amount of the contributions required from its members. They have accordingly been adopted in the model rules which have been drawn up by the Board, and which will shortly be issued. These rules incorporate the best practice of existing clubs, and will be available for guidance to all societies and to all communities of pig-owners who contemplate the establishment of a co-operative society for the insurance of their pigs.

Re-Insurance.

One of the dangers to which a small pig insurance society is exposed is that, owing to the outbreak of some contagious disease, a considerable proportion of the insured pigs owned by the members might die within a short period and have to be paid for from the funds of the society, and this might involve a heavy levy on the members in addition to their usual insurance contributions In this country, however, that danger is to some extent reduced where the disease is swine fever, as the Board in some outbreaks slaughter a portion or the whole of the swine on the premises, paying compensation for pigs so slaughtered On the average of the five years ending March, 1913, there have been annually in Great Britain 2,154 outbreaks of swine fever, in consequence of which 23,591 pigs were slaughtered by order and £32,869 was paid as compensation from public funds, so that the average number slaughtered was eleven pigs per outbreak, and the average amount of compensation paid was about £1 8*s* per pig slaughtered, and about £15 per outbreak. The model rules provide that the compensation paid by the Board is to be deducted from the compensation payable under the rules, so that in the case of swine fever the amount of compensation payable by the society will not exceed the value of pigs which have actually died from that disease, and a portion of the value of the pigs which have been slaughtered by the Board. Moreover, seeing that in the course of every year there must be about seven million pigs alive in Great Britain, the risk to any particular pig of being affected by swine fever is, on the average, small. As a matter of fact, the experience of nearly a thousand successful pig insurance societies in the country shows that there is no great risk of a society's becoming insolvent owing to an outbreak of contagious disease among the insured pigs.

There is, however, the possibility that, owing to a succession of bad years, the losses may exceed the ordinary insurance contributions, and it is for this reason that it is so important that a pig insurance society, which has no outside resources to depend upon, should build up a substantial reserve fund against the risk of having to make levies on its members to meet such deficiencies This risk may be greatly reduced by a system of re-insurance, under which a larger body will undertake, in return for a proportion of the insurance contributions, to pay a proportion of the losses incurred by the society Such a system has been arranged by the Agricultural and General Co-operative Insurance Society, Ltd , Dacre House, Dacre Street, Westminster, London, S W., which has expressed its willingness to re-insure half the net risks of any local co-operative pig insurance society, if satisfied with its rules and financial position, on payment

of half the insurance contributions received by the local society, less 10 per cent. of that half. One advantage of such an arrangement to a small co-operative pig insurance society will be that it will only have to provide for half the net loss incurred on the death of an insured pig, while it will retain 55 per cent, that is, more than half of the insurance contributions; and should it have to make a levy on its members owing to a deficiency in its own insurance fund, that levy will only have to be half of what it would have been if the society had not made the contract of re-insurance. Another great advantage is that it will not be necessary for the local society to build up such a large reserve fund as if it had to depend entirely upon its own resources, seeing that the amount it will have to provide for in the case of a deficiency will only be half of what it is in the case of a society which has not re-insured its risks. The pig clubs for which statistics have been collected hold reserve funds amounting altogether to nearly £30,000, mostly representing the savings of working men. This large sum is wisely kept in the Savings Bank, where it only earns 2½ per cent interest, and so far as it is unnecessarily large, it involves a loss in possible usefulness to the members of the societies which have saved up this amount. If it can be reduced with safety, those members will be able to reap a greater advantage from their past thrift and good management In the model rules it is provided that, whenever the balance to the credit of the insurance fund of any society is shown by the audited accounts of any year to exceed the equivalent of 10*s* per pig on the maximum number of pigs insured during the year, the insurance contributions of all members of over five years' standing shall be reduced to half the usual rates for the following twelve months The reason why 10*s* per pig has been selected as the maximum insurance fund to be aimed at is that the average amount of compensation annually payable by insurance societies is found to be under 2*s*. per pig on the number of pigs insured, so that a reserve fund of 10*s* per pig would in itself cover the average losses of five years, and this seems a sufficient reserve for a self-supporting society. But if, under a contract of re-insurance, a local society remains liable for only half the total amount of compensation payable, it need only expect an average loss to itself of less than 1*s*. per pig insured per annum, so that in that case a reserve fund of 5*s* per pig insured would be sufficient to meet the average losses of five years Such a society may therefore safely grant to its old members the benefit of a reduction of the insurance contributions to half the usual rates, so long as the balance at the credit of the insurance fund exceeds that amount

It will be necessary for each local society which wishes to re-insure on these terms to satisfy the General Society that its rules and financial position are sound, and to obtain that society's consent to the reduction of its rates when its reserve exceeds the required sum. Should the application be accepted and the assent of the General Society be obtained, the old members of a society which has already accumulated a good reserve will find that their insurance contributions can be at once reduced to half the usual rates, that is, in an average society, to about 1*s*. per pig per annum, making with the contribution for management expenses a total payment of about 2*s*. per pig per annum to cover loss by death from accident or disease.

STATISTICS OF REGISTERED PIG

Serial Number	Name of Society	County.	Year of Registration.	No. of Members.	No. of Pigs Insured.	No of Pigs on which claims were paid during the year.
1	Langworth	Lincoln .. .	1859	39	61	3
2	Kirton-in Lindsey	Lincoln .. .	1862	59	84	12
3	Conisborough ..	York	1863	24	42	1
4	Aberford .	York ..	1865	44	37	5
5	First Billinghay	Lincoln .	1865	46	71	3
6	Bucknall .	Lincoln .	1866	25	49	2
7	Nocton ..	Lincoln .	1866	22	27	—
8	Bardney	Lincoln .	1866	35	46	6
9	Scawby	Lincoln	1870	45	75	9
10	Hugglescote	Leicester .	1872	—	—	—
11	Blankney .	Lincoln .	1873	17	28	2
12	Bredon .	Worcester ...	1878	87	131	5
13	Werrington	Northants	1878	135	248	18
14	Caistor ..	Lincoln	1881	41	57	5
15	Sutterton	Lincoln ..	1881	87	128	7
16	Eckington . ..	Worcester	1886	36	50	—
17	Kemerton .	Gloucester .	1887	92	126	3
18	Crowland	Lincoln ..	1887	71	177	11
19	Billinghay ..	Lincoln ..	1888	64	108	2
20	Walcot	Lincoln .	1889	36	45	4
21	Old Fletton .	Huntingdon .	1890	69	196	4
22	Amber Hill	Lincoln	1890	9	13	2
23	Beckford .. .	Gloucester	1890	30	39	2
24	Louth	Lincoln ...	1891	90	195	13
25	Horsington. .	Lincoln ..	1891	20	37	1
26	Stanway ...	Gloucester	1894	53	102	4
27	Winchcombe ..	Gloucester	1904	21	23	—
28	Kingsthorpe .	Northampton	1906	—	—	—
29	Dumbleton	Gloucester .	1906	33	47	4
30	Calne ...	Wiltshire	1906	60	391	11
31	Cobholm .	Norfolk ...	1910	28	346	6
32	Alderton .	Gloucester .	1911	14	22	—
33	Temple Guiting...	Gloucester ..	1911	29	65	3
	Total ...	... .	.	1,461	3,066	148

INSURANCE SOCIETIES FOR 1912.

Insurance Fund.						
Amount at the beginning of the year	Income					Serial Number.
	Insurance Contributions	Entrance Fees and Fines	Interest.	Sales of Pigs and Carcasses.	Total Income.	
£ s	£ s	£ s.	£ s.	£ s.	£ s	
39 2	7 14	—	18	—	10 14	1
72 12	9 12	1 1	1 17	—	12 10	2
17 13	6 11	11	8	—	7 9	3
19 15	3 17	—	—	8	5 13	4
95 3	9 6	3 2	2 6	—	14 14	5
33 11	2 15	—	16	—	3 11	6
23 1	5 9	7	—	—	7 3	7
17 14	9 12	—	—	9 10	19 2	8
138 10	8 0	1	3 9	19	12 9	9
—	—	—	—	—	—	10
96 4	—	—	2 7	—	2 7	11
151 2	7 13	—	3 14	—	11 7	12
125 17	14 12	6 6	2 16	5 8	23 4	13
59 0	13 4	—	1 6	3 13	18 3	14
146 8	18 1	1 0	3 8	4 2	26 11	15
70 14	5 3	3	1 16	—	7 2	16
176 18	7 7	—	4 8	—	12 7	17
7 4	17 9	16	—	7 15	31 11	18
57 15	15 12	3	1 9	—	17 4	19
63 10	2 11	7	1 9	1 15	6 3	20
76 11	4 13	5 8	1 16	—	12 3	21
20 0	3 2	—	8	—	3 10	22
62 10	1 6	1	1 11	—	2 18	23
129 2	10 9	5	3 4	12 19	32 17	24
10 4	2 2	1	5	—	2 8	25
68 9	5 15	4	1 9	—	7 8	26
40 10	2 12	3	—	—	2 15	27
—	—	—	—	—	—	28
25 4	5 6	4	11	—	8 3	29
13 11	20 3	—	—	—	39 4	30
42 9	10 4	—	1 2	—	13 17	31
11 12	4 3	—	—	—	4 3	32
—	5 3	1 9	—	—	6 12	33
1,884 13	239 6	21 12	42 13	46 9	385 2	

STATISTICS OF REGISTERED PIG

Serial Number.	Name of Society.	County.	Insurance Fund. Expenditure. Paid on Claims.	Dividend to Members.	Total Payments.	Amount at the end of the year.
			£ s.	£ s.	£ s.	£ s.
1	Langworth	Lincoln ...	8 2	—	8 2	41 14
2	Kirton-in-Lindsey	Lincoln ...	15 8	—	15 8	69 14
3	Conisborough ...	York ..	2 15	—	4 19	20 3
4	Aberford	York	21 3	—	23 15	1 13
5	First Billinghay ...	Lincoln ...	3 18	—	7 13	102 4
6	Bucknall	Lincoln ...	4 18	—	4 18	32 4
7	Nocton ...	Lincoln ...	—	—	2 17	27 7
8	Bardney	Lincoln ...	16 13	—	16 13	20 3
9	Scawby	Lincoln ...	9 2	—	9 11	141 8
10	Hugglescote... ..	Leicester	—	—	—	—
11	Blankney ...	Lincoln ...	3 6	—	3 6	95 5
12	Bredon ...	Worcester ...	22 0	—	22 0	140 9
13	Werrington	Northants	42 9	—	42 9	106 12
14	Caistor ...	Lincoln ...	10 16	4 16	15 12	61 11
15	Sutterton	Lincoln	25 5	—	28 5	144 14
16	Eckington ...	Worcester ...	—	—	—	77 16
17	Kemerton ...	Gloucester .	13 5	—	13 5	176 0
18	Crowland ...	Lincoln ...	27 9	—	33 10	5 5
19	Billinghay	Lincoln ..	1 19	—	7 5	67 14
20	Walcot	Lincoln	15 5	—	18 8	51 5
21	Old Fletton	Huntingdon .	10 0	—	10 0	78 14
22	Amber Hill	Lincoln ...	4 18	—	5 11	17 19
23	Beckford	Gloucester ...	2 10	—	2 10	62 18
24	Louth	Lincoln ...	28 15	—	28 15	133 4
25	Horsington	Lincoln ...	1 1	—	1 1	11 11
26	Stanway	Gloucester ...	13 2	—	13 2	62 15
27	Winchcombe ...	Gloucester ...	—	—	—	43 5
28	Kingsthorpe...	Northampton	—	—	—	—
29	Dumbleton	Gloucester ...	2 13	—	5 5	28 2
30	Calne	Wiltshire ...	9 14	—	11 14	13 19
31	Cobholm	Norfolk .	8 16	—	8 16	47 10
32	Alderton	Gloucester ...	—	—	4 9	11 6
33	Temple Guiting ...	Gloucester	6 9	—	6 9	0 3
	Total	... ...	331 11	4 16	375 8	1,894 7

INSURANCE SOCIETIES FOR 1912.

Management Fund.				Assets.		Serial Number.
Income.		Expenditure.				
Contributions and Levies.	Total Income.	Salaries.	Total Expenditure.	Deposits in Bank.	Total Assets.	
£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	
1 19	2 5	1 10	1 19	36 9	43 10	1
—	2 6	1 10	1 10	78 12	81 1	2
—	—	—	—	17 7	20 3	3
—	—	—	—	1 5	1 13	4
—	—	—	—	101 5	102 4	5
2 6	2 6	0 10	2 6	32 14	32 14	6
—	—	—	—	20 14	27 7	7
1 4	1 8	1 4	2 6	—	20 3	8
—	—	—	—	141 5	141 8	9
—	—	—	—	—	—	10
3 0	4 11	—	2 18	90 15	96 17	11
2 14	2 19	2 8	3 3	139 9	142 18	12
2 6	8 3	4 0	8 3	103 11	106 12	13
2 15	4 17	3 10	5 7	55 8	64 14	14
—	—	—	—	135 8	144 14	15
1 4	1 4	0 12	0 19	80 6	80 7	16
3 8	4 2	1 15	4 2	176 0	176 0	17
—	—	—	—	4 4	5 5	18
—	—	—	—	48 11	67 14	19
—	—	—	—	46 14	51 15	20
1 10	1 10	2 18	3 4	74 6	77 1	21
—	—	—	—	16 12	17 19	22
1 0	1 1	0 5	1 2	62 6	63 4	23
13 10	15 5	5 5	11 18	137 0	149 11	24
0 7	0 8	—	0 5	9 11	12 5	25
1 17	1 18	1 0	2 7	60 18	63 13	26
0 13	0 18	1 0	1 13	38 13	43 5	27
—	—	—	—	—	—	28
1 1	1 6	—	0 17	23 12	30 7	29
2 0	6 9	5 0	26 4	—	17 7	30
2 4	2 4	0 10	1 19	48 18	48 18	31
0 9	0 14	0 12	1 1	13 8	13 8	32
0 18	2 16	—	3 0	—	2 8	33
46 5	68 0	33 9	86 3	1,795 1	1,941 9	

Moulton Chapel Cow Insurance Club.

The large parish of Moulton, near Spalding in Lincolnshire, in which Moulton Chapel is included, has a cultivable area of over 11,000 acres, of which 3,000 acres are under permanent grass and 8,000 arable. There are in the parish over 2,200 cattle, including about 420 cows and heifers in milk or in calf. The land is held in about 260 holdings, of which nearly 200 are under fifty acres in area, so that it is to a large extent a parish of small-holders.

A number of cow-owners, living in and near Moulton Chapel, founded a club in 1884 "for the purpose of assisting each other in acts of benevolence when overtaken by misfortune,"—the form of misfortune contemplated being the loss of dairy-cows by disease or accident. The club has not been registered under the Friendly Societies' Act.

The number of members has increased in the last eight years from 110 to 124, most of whom are small-holders, and the number of cows insured has risen in the same period from 211 to 274, which gives an average of 2·2 cows per member. The club insures only cows and heifers. The largest number insured by any one member is six.

On the average of the last eight years, the number of cows insured was 246, and the number of cows that died each year was 6·6, which gives an average death-rate per annum of 2·7 per cent. This is somewhat higher than the average death-rate of 2·4 per cent., which is given by the figures for the cow clubs in England and Wales, taken together, over the two last years, but compares favourably with the average death-rate of 3 per cent. given by the experience of a large and well-managed dairying concern, and with the average death-rate of 6 per cent., which seems to be the experience of insurance companies as regards dairy cows insured with them. At Moulton Chapel the death-rate in the best year was only 1·1 per cent., and in 1911, which was the worst of the eight, it was 4·3 per cent., twelve cows having died out of 281 insured.

The club pays three-fourths of the market value of any cow that dies from disease or accident, and recently paid £15 on one cow valued at £20; but the average value of the cows insured is only about £15, and, on the average of the last eight years, the amount of compensation paid was £70 11*s*. per annum for an average of 6·6 cows, which gives the average amount paid per cow as £10 14*s*. As a set-off against this loss, the club received from the sale of carcasses an average of £8 6*s*. per annum, which gives an average price per carcass of £1 5*s*. The net loss to the club per cow insured averaged 5*s*.

A large item in the expenditure of the club is the cost of the annual dinner, which every member is expected to attend, unless he has a good excuse for absence. One of the rules lays down that to meet the cost of this dinner each member will pay 1*s*., and that the remainder will be met out of the funds. Under this rule there was an average expenditure on the dinner of £12 14*s*., while the subscriptions amounted to £4 18*s*.; so that the net cost to the club of the dinner was £7 16*s*. per annum, which gives an average of 1*s*. 3*d*. per member and of 7½*d*. per cow insured. The other costs of management of the society averaged £6 16*s*., or about 6½*d*. per cow insured, which is about the average for all the cow clubs in England taken together.

Altogether the average expenditure of the club amounted to £90 1*s*.,

against which there was an average income of £102 5*s*., the principal item in which was the average premium income of £79 2*s*.; but there was also, besides the items already mentioned of £4 18*s*. towards the cost of the dinner, and of £8 6*s*. from the sale of carcasses, an income averaging £10 per annum from interest on the Reserve Fund. The club has thus, on the average, made a saving of £12 4*s*. per annum during the last eight years; and at the end of last year its Reserve Fund, built up by the savings of past years, amounted to £337 10*s* of which the club has managed to invest £200 at 5 per cent.

A new member, on joining the club, has to pay an entrance fee of 2*s*. 6*d*. for the first cow entered and 1*s*. for each cow after the first. He has also to pay in advance an insurance premium of 1*s*. 6*d*. per quarter for each cow, that is, at the rate of 6*s*. per annum; and seeing that the average losses of £70 11*s* per annum on 246 cows insured come to 5*s*. 9*d*. per annum per cow insured, the premium paid just covers the average annual losses, and the club has to meet its other expenses from the income from interest, sale of carcasses, entrance fees, &c., which is more than sufficient for this purpose.

The officers of the club are a president, vice-president, secretary, treasurer, and marker, the latter of whom has to see that every cow offered for insurance is sound and free from disease, and who is paid by the owner 6*d*. for each cow that he marks as accepted for insurance. The valuation of any cow that may fall ill or die is made by a committee of three members, who have power to add to their number, and whose valuation is final.

The club has recently suffered a severe loss in the death of its late secretary, Mr Eggleston, a potato-merchant and small-holder to whose careful account-keeping much of its success is due Its affairs are evidently in a sound condition, and it is economically managed, except in the matter of the annual dinner. If the members would agree to pay the whole cost of the dinner out of their own pockets, instead of charging part of it to the funds of the club, their experience for the last eight years would seem to make it safe for them now to reduce their premium charged per cow by 1*s*. a year, that is, from 1*s* 6*d*. to 1*s*. 3*d*. per quarter, so long as the amount at credit of the Reserve Fund does not fall below £1 per cow insured.

OFFICIAL NOTICES AND CIRCULARS.

The Board of Agriculture and Fisheries have addressed the following circular letter, dated October 15th, 1913, to Local Authorities in Wales on Agricultural Education:—

Special Grant for Agricultural Education in Wales.

SIR,

I am directed by the Board of Agriculture and Fisheries to inform you that they have been for some time past conferring with the Development Commissioners with a view to obtaining a special grant for agricultural education in Wales.

The proposal which the Board made to the Development Commissioners on the advice of the Agricultural Council for Wales was, briefly, that the work of agricultural education in the Welsh counties (excluding Glamorgan and Monmouth) should be undertaken by the

Agricultural Departments of Aberystwyth and Bangor Colleges. For this purpose it was proposed that an additional staff should be appointed adequate to the needs of the area, and that the whole of the expenditure involved should be defrayed from funds placed at the disposal of the Board by the Development Commissioners.

After very careful consideration of the whole matter, the Development Commissioners have come to the conclusion that they are unable, having regard to the intentions of Parliament in creating the Development Fund, to sanction a grant to cover the whole cost.

They point out that the grant which has already been made for the promotion of agricultural education at, or in connection with, Farm Schools and Farm Institutes, enables the Board to pay from one-half to three-quarters of the additional expenditure borne by Local Authorities for this purpose, and they consider that in view of the benefits to be received by the ratepayers from an extension of agricultural instruction, it is not unreasonable to require that the balance should be borne by local funds.

The Board hope that your Authority will see their way to fall in with this view, and they would point out that the very substantial grants which they are prepared to make will enable a material extension in agricultural education to take place without increasing to more than a trifling extent the net expenditure of the county on higher education generally.

In order to make this point clear, it may be convenient to explain briefly that the grants will be based on the excess expenditure incurred for agricultural education over and above the average expenditure incurred in the three years ending March 31st, 1912. Assuming, for example, that the average expenditure of a county in these three years was £500, and that this was increased to £1,000 in carrying out work of an approved type, then the Board would pay a proportion of this additional sum of £500. The actual proportion for each county in Wales varies according to its past expenditure from about 60 to 75 per cent., but most counties would earn about 70 per cent. If, in the example mentioned above, the grant was at this rate, it will be seen that the Board would pay £350 and the county only £150 towards a total increased expenditure of £500.

The benefits obtainable by the locality under these conditions at a very small expenditure on its part are obvious, and in view of the admitted need for agricultural education in Wales, the Board trust that your Authority will see their way to take advantage of the scheme forthwith.

As regards the method to be adopted, I am to invite attention to the enclosed circular letter* of March 27th last, and to the Memorandum A.249/I, which sets out in more detail the conditions on which grants will be made. I am at the same time to explain that, although Local Education Authorities may undertake the work themselves, the Board recommend, in view of the circumstances of most Welsh counties, that arrangements should be made whereby instruction of the type contemplated in the Circular and Memorandum may be provided for groups of counties by the University College of Wales, Aberystwyth, and the University College of North Wales, Bangor.

* Not printed.

In either case, it is desirable that a definite scheme of agricultural education in the county should be drawn up setting out in detail the steps to be taken, and that this scheme should in due course be submitted to the Board for approval. In the meantime, the Board will be prepared to approve suitable forms of work with a view to the payment of a grant in respect of the current year ending March 31st next, and I am to ask that for that purpose application should be made on the accompanying form* at an early date.

I am, &c.,
SYDNEY OLIVIER.

Outbreak of Foot-and-Mouth Disease in Sussex

The existence of Foot-and-Mouth Disease amongst cattle at Street Farm, Westham, near Eastbourne, East Sussex, was confirmed on November 12th.

The usual precautions have been taken to prevent the spread of the disease, and an Order has been issued prohibiting the movement of animals in a large area surrounding the affected farm.

MISCELLANEOUS NOTES.

The Wages of Agricultural Labourers.

A report † recently published by the Board of Trade gives some indication of the extent to which agricultural labourers have shared in the upward trend of wages in recent years. Although it is difficult to ascertain the actual wages of agricultural labour on account of the "extras" (i e., extra cash payments for piece-work or harvest, and allowances in kind) which still form part of the payment of these men, changes in their earnings can be estimated fairly accurately, as these take place chiefly in the current rate of cash wages.

The method followed by the Board of Trade in estimating these changes is to combine the ascertained changes in the weekly rates of wages of ordinary labourers in the rural districts with the estimated total number of agricultural labourers of all classes employed in these districts. It is true that in most districts certain classes of labourers, such as foremen and shepherds, would not immediately be affected by such changes. Again, in some localities, changes in the wages of ordinary labourers do not always affect the wages of men in charge of horses and cattle, and in some places where changes are made they are not necessarily of the same amount as in the case of ordinary labourers, nor do they always take place at the same time. But on the whole it is probably the case that the wages of the greater number of the higher paid farm labourers follow the course of the wages of the ordinary labourers, and the following results shown for a series of ten years for England and Wales on this basis may be regarded as yielding a fairly good comparison of the movement in wages :—

* Not printed.

† Report on Changes in Rates of Wages and Hours of Labour in 1912 Cd. 7080], 1913

Year.	Estimated Total No. of Agricultural Labourers in Districts in which the predominant rates of wages		Computed amount of change (compared with each preceding year) in average weekly cash wages of the Agricultural Labourers in Districts affected.		
	Were Raised	Were Lowered.	Increase.	Decrease.	Net Increase (+) or Decrease (−).
	No	No.	£	£	£
1903	51,095	24,953	1,449	893	+ 556
1904	23,779	9,569	1,032	451	+ 581
1905	6,659	12,438	252	442	− 190
1906	14,758	8,744	704	322	+ 382
1907	14,971	3,439	479	103	+ 376
1908	40,134	13,780	1,411	684	+ 727
1909	29,244	19,772	747	451	+ 296
1910	15,451	271	794	22	+ 772
1911	25,427	4,360	1,214	270	+ 944
1912	102,602	1,846	5,383	92	+5,291

It will be seen from the above table that wages showed a considerably greater rise in 1912 than in any of the previous nine years, the net increase (£5,291) being the largest recorded since 1900, when it was estimated at £8,150, affecting 230,635 labourers The total amount (£92) represented by the decrease is, with the exception of 1910, the smallest since 1900, when no decreases were reported.

The total number of labourers affected by the changes reported in 1912 was 104,448; while the total number of labourers living in districts in which no change was reported was 291,586. The corresponding totals in 1911 were 29,787 and 370,958 respectively.

The majority of the changes which took place in 1912 consisted of amounts of over *6d.*, but not over *1s.*, a week In the table on p. 735 the numbers of agricultural labourers in England and Wales affected by changes in rates of wages are grouped according to the estimated average weekly amount of change.

Most counties shared in the upward movement of wages in 1912. Those counties in which it was most marked, taking into account the total number of labourers in each county, were Cumberland, Cheshire, Worcestershire, Lincolnshire, Essex, Carmarthen, and Flintshire

It may be of interest to note that the actual weekly rates of cash wages of ordinary agricultural labourers were highest (viz., *23s.*) in the Lanchester district of Durham and the Chesterfield district of Derby, while they were lowest (viz., *13s.*) in Norfolk, Suffolk, several rural districts of Essex, the Campden district of Gloucestershire, Shipston-on-Stour (Worcestershire), Bideford (Devon), and (viz., *11s.* to *12s*) Beaminster (Dorset).

Year.	Estimated number of Agricultural Labourers whose wages were changed by					Computed Amount of Change in Weekly Cash Wages.
	6*d* and under per week.	Over 6*d* and up to 1*s* per week	Over 1*s* and up to 2*s* per week.	Over 2*s* per week	TOTAL.	
	INCREASES.					
						£
1903	28,914	20,062	1 858	261	51,095	1,449
1904	4,437	17,779	1,563	—	23,779	1,032
1905	1,531	4,752	376	—	6,659	252
1906	—	12,944	1,814	—	14,758	704
1907	8,755	5,342	874	—	14,971	479
1908	15,612	20,431	4,091	—	40,134	1,411
1909	17,213	9,644	2,387	—	29,244	747
1910	5,839	5,355	3,733	524	15,451	794
1911	5,241	16,592	3,594	—	25,427	1,214
1912	25,760	52,751	21,681	2,410	102,602	5,383
	DECREASES					
						£
1903	5,739	18,397	817	—	24,953	893
1904	1,814	6,449	1,306	—	9,569	451
1905	3,000	9,438	—	—	12,438	442
1906	1,911	6,833	—	—	8,744	322
1907	1,216	2,223	—	—	3,439	103
1908	4,919	3,567	5,080	214	13,780	684
1909	11,890	7,748	134	—	19,772	451
1910	—	97	174	—	271	22
1911	1,064	1,638	1,658	—	4,360	270
1912	—	1,846	—	—	1,846	92

Notes on Agriculture Abroad.

State-aided Purchase of Stock on behalf of Farmers in Rhodesia.—*The Rhodesian Agricultural Journal* for August, 1913, gives the amended conditions for the purchase by the Government of pure-bred live stock for farmers. The terms of payment for the live stock by farmers are as follows:—(1) A deposit on application; (2) one-third of the total cost, less the amount of the deposit, on delivery of the animals; (3) one-third after six months; and (4) one-third after twelve months—both the latter instalments bearing interest at 6 per cent., or 10 per cent. if not paid punctually. These terms of credit are only allowed on purchases not exceeding £200. The buyer must undertake to accept the animal allotted to him, unless it fails to satisfy the description given in the application. The purchase price will include all expenses up to the time of delivery. Pedigrees will be supplied if obtainable, and the Government will bear all risks of transport and of death from any cause until delivery. The Department of Agriculture does not undertake to purchase stock at precisely the prices specified by applicants, but will endeavour not to exceed the figures given by over 20 per cent.

Poultry Disease in Belgium.—The Belgian districts of Malines and Londerzeel were for some years previous to 1911 the centres of a highly prosperous poultry-fattening industry. A speciality is made in this part of Belgium in fattening poultry for table purposes, particular attention being paid to the production for the Brussels market, and for despatch to France and Germany, of the *poulet de Bruxelles,* a fowl of the Malines type and noted for its white, soft flesh. So lucrative was the industry that every person possessing any land in the district tried its capacity for rearing chickens to the utmost. In time the system necessarily became a very intensive one, and it is feared that many rearers failed to observe proper precautions against tainted ground, in-breeding, and other unhealthy conditions, which combined to reduce the vitality of the birds and rendered them easy victims to the disease which overtook them in 1911.

The disease which has raged for the last two years has had disastrous effects on the once prosperous industry. The mortality among chickens is often as high as 60 per cent., and even laying hens are not immune. Many important rearing establishments have been abandoned, and the situation became so serious that the Belgian Government requested Professors J. L. Frateur and L. Maldague, of Louvain University, to investigate the cause of the disease. The investigation was duly undertaken, and according to their first report, which has now been published, Professor Frateur and his colleague have ascertained that the disease, both of the young chickens and the adult fowls, is produced by a microbe of the bacillus type. The disease may be contracted in various ways. Infection may take place while the egg is still in the ovary, and a considerable proportion of the embryo chickens succumb during the process of hatching. Further, many chickens which are hatched fall early victims, the mortality during the first three weeks being especially high. The infected chickens may transmit the disease to other chickens and also to adult fowls. Healthy fowls may be infected by pecking at soil contaminated by excrement containing the germ, which may also gain entrance through open wounds, through the respiratory organs, or may be carried by workmen and birds on utensils from infected areas.

With chickens the disease may be either acute or chronic. The most noteworthy symptoms are refusal of food, emaciation, sleepiness, lack of vivacity, and irregular diarrhœa. Attacked by the acute form the chickens speedily die, but when chronic the disease is of longer duration, and the victims usually succumb after a gradual decline. It is remarkable that with adult fowls there are few manifest symptoms of the disease, especially in the earlier stages; the hens, however, soon begin to lay badly, and later become very emaciated and dejected in appearance. Victims of the disease usually show a positive reaction to serum treatment.

The investigators suggest certain preventive and remedial measures. Great care must be taken to prevent contamination of healthy places. Eggs, chickens, and poultry from infected areas must be completely excluded, and the introduction of disease by workmen, utensils, or birds avoided.

Where disease already exists it is advisable to destroy every chicken and fowl. Chickens that are infected should be sacrificed at once, and the remainder disposed of for table purposes as soon as they are saleable.

The adult fowls may be fattened before they are sold. The soil near the entrance to the houses and round the eating troughs should be thoroughly disinfected with a solution of sulphuric acid, while the houses themselves should be treated with formaldehyde vapour or some other disinfectant. Valueless utensils should be burnt and the remainder disinfected.

The investigators believe that later on effective serum treatment may be introduced, but at present such treatment has met with little success.

The Weather in England during October.

District.	Temperature. Daily Mean	Temperature. Diff from Average.	Rainfall Amount.	Rainfall Diff' from Average.	Rainfall Number of Days with Rain.	Bright Sunshine. Daily Mean	Bright Sunshine. Diff. from Average
	°F.	°F.	Inches.	Inches		Hours	Hours
Week ending Oct. 4th							
England, N E	56·7	+6·3	0·34	−0 19	3	3 4	−0 3
England, E.	58·8	+7·3	0 26	−0·32	3	5 4	+1·5
Midland Counties . .	57 5	+7·2	0·74	+0 12	3	2 8	−0 7
England, S E	59·2	+6 3	0 30	−0 40	3	5 1	+1 2
England, N W. ...	57 7	+6 6	0·13	−0 80	1	3·8	+0·6
England, S W.	58 4	+6 0	0·58	−0 42	3	3·0	−0·8
English Channel	60 5	+4 8	0·69	−0 16	5	3 6	−0·9
Week ending Oct 11th							
England, N E	50·6	+1 8	1 53	+0 87	5	2 6	−0·7
England, E. ...	52·9	+3 1	1·32	+0 69	5	3 1	−0·5
Midland Counties ...	51 3	+2 7	1·68	+1 01	5	1 8	−1 5
England, S E .	54 2	+3 1	1 58	+0 86	5	2 7	−1·0
England, N W.	51 1	+1·5	0 77	−0 16	5	2 2	−0 7
England, S. W .	53·8	+2·9	1 62	+0 59	5	3 7	+0 2
English Channel	56·4	+2 1	1 19	+0 31	6	5·3	+1·1
Week ending Oct. 18th							
England, N E.	51·6	+4 1	0 09	−0 65	2	3 1	+0·1
England, E	52 2	+3 9	0 25	−0 40	3	3 9	+0 6
Midland Counties	50 9	+3·7	0·11	−0·55	2	3·4	+0 4
England, S.E .	53 8	+4 1	0 08	−0·65	1	4·8	+1 4
England, N W ...	52 7	+4 4	0 51	−0·35	2	3·0	+0·3
England, S.W	54 1	+4·4	0·14	−0·87	1	4·8	+1 5
English Channel	56·6	+3 4	0·04	−0·88	2	6·5	+2 5
Week ending Oct. 25th							
England, N.E.	47 5	+1·1	0·18	−0 55	3	3 8	+1 2
England, E. . .	49·1	+2·0	0 57	−0 05	3	4·0	+1·0
Midland Counties	47·7	+1·6	0 20	−0 45	2	3 4	+0·9
England, S E....	51 1	+2·5	0 84	+0·07	2	3 3	+0·3
England, N.W. .	47 3	+0 1	0 50	−0·36	4	4·3	+1·8
England, S.W.	50 4	+1 6	0·48	−0·55	4	3 7	+0 8
English Channel .	54 2	+1·9	1·30	+0·38	3	4·0	+0·5
Week ending Nov. 1st							
England, N. E.... ...	50·7	+5·1	0·41	−0·25	5	3 2	+1·0
England, E.	53 4	+7 1	0·97	+0 40	5	2·8	+0 1
Midland Counties ...	50·6	+5·2	0·94	+0·28	6	3·0	+0·8
England, S E. ...	54·4	+6 4	1 21	+0·40	6	2·8	+0·2
England, N.W. ..	51·9	+5·3	1·06	+0·15	6	2·7	+0·6
England, S.W. ...	52·9	+4 7	1·69	+0·59	6	2·4	−0·1
English Channel . .	55·5	+3·9	1·08	+0 13	6	3 7	+0·7

The Board of Agriculture and Fisheries have issued the following preliminary statement showing the estimated total production of hops in the years 1913 and 1912, with the acreage and estimated average yield per statute acre in each county of England in which hops were grown:—

Produce of Hops in 1913.

Counties, &c.		Estimated Total Produce.		Acreage Returned on 4th June.		Estimated Average Yield per Acre	
		1913.	1912	1913.	1912.	1913.	1912.
		Cwt	Cwt.	Acres	Acres	Cwt	Cwt
Kent	East	47,395	74,415	6,103	5,993	7·77	12·42
	Mid ..	73,899	85,718	7,481	7,330	9·88	11·69
	Weald	65,480	100,277	8,360	8,077	7·83	12·42
	Total, Kent	186,774	260,410	21,944	21,400	8·51	12·17
Hants		7,274	18,473	1,556	1,516	4·67	12·19
Hereford		22,138	29,450	5,439	5,236	4·07	5·62
Surrey		2,959	5,264	557	513	5·31	10·26
Sussex		22,536	34,098	2,889	2,845	7·80	11·99
Worcester		13,500	24,880	3,157	3,186	4·28	7·81
Other Counties *...		460	863	134	133	3·43	6·49
Total		255,641	373,438	35,676	34,829	7·17	10·72

* Gloucester, Salop, and Stafford.

NOTE.—The total production in 1913 is estimated at 255,641 cwt., which is smaller than in any year since 1909, and 118,000 cwt. less than last year. The average yield per acre is 7·17 cwt. or 21 per cent. below the average of the past ten years and about 33 per cent. less than last year.

Area under Crops and Number of Live Stock.

The Preliminary Statement of the Agricultural Returns for England and Wales collected in June last shows a decrease in the total area under crops and grass of 45,308 acres. The decline in the arable land amounts to 277,000 acres, most of which was transferred to permanent pasture, and the latter area now for the first time surpasses 16,000,000 acres. Wheat shows a decline of 162,000 acres, the total thus reverting to rather less than in 1910. Oats also decreased by 98,000 acres; but the area under barley has increased by 102,000 acres. Most of the other crops show a decline, probably owing to the difficulties of the sowing season. Bare fallow increased by 114,000 acres; thus emphasising the conditions of the early part of the year. Potatoes declined by 21,000 and mangolds by 66,000 acres. Clover and grasses under rotation fell off by 27,000 acres; but the area reserved for hay, whether seeds or meadow, shows an increase of 273,730 acres.

The live stock returns show decreases among all classes of animals. The decline among horses is slight, and the reduction in horses used for agricultural purposes is probably mainly due to a transfer of many

animals from this class to that of "other" horses on the farms, a more precise definition of the latter having been introduced into the schedule this year. Cattle show a reduction of 124,776, but there are increases in the categories of cows in calf and of other cattle of two years and above. The total number of cows—2,264,403—is about the same as in 1905. Sheep have declined by over 900,000, while among swine the decrease amounts to nearly 16 per cent.; the total being now somewhat more than in 1901.

The area under woods and plantations is returned as 1,887,683 acres, as compared with 1,899,834 acres in 1905.

PRELIMINARY STATEMENT for 1913, compiled from the Returns collected on the 4th June, and comparison with 1912.

CROPS.

DISTRIBUTION	1913.	1912	INCREASE		DECREASE	
	Acres	*Acres*	*Acres*	*Per Cent*	*Acres*	*Per Cent*
TOTAL AREA (excluding WATER)	37,138,765	37,138,765	—	—	—	—
TOTAL ACREAGE under all CROPS and GRASS (*a*)	27,129,382	27,174,690	—	—	45,308	0 2
ARABLE LAND	11,058,233	11,335,276	—	—	277,043	2 4
PERMANENT GRASS (*a*) — For Hay	5,069,692	4,941,534	128,158	2 6	—	—
PERMANENT GRASS (*a*) — Not for Hay	11,001,457	10,897,880	103,577	1 0	—	—
PERMANENT GRASS (*a*) — TOTAL	16,071,149	15,839,414	231,735	1 5	—	—
Wheat	1,701,588	1,863,364	—	—	161,776	8 7
Barley	1,558,856	1,456,528	102,328	7 0	—	—
Oats	1,974,700	2,072 479	—	—	97,779	4·7
Rye	51,506	54,133	—	—	2,627	4 9
Beans	268,279	277,001	—	—	8,722	3 1
Peas	164,044	201,135	—	—	37,091	18 4
Buckwheat	3,686	4,990	—	—	1,304	26 1
Potatoes	442,035	462,903	—	—	20,868	4 5
Turnips and Swedes	1,053,312	1,072,043	—	—	19,631	1 8
Mangolds	419,583	485,664	—	—	66,081	13 6
Cabbage	55,422	61,422	—	—	6,000	9 8
Kohl-Rabi	14,401	20,352	—	—	5,951	29 2
Rape	67,351	79,375	—	—	12,024	15 1
Vetches or Tares	100,945	129,805	—	—	28,860	22 2
Lucerne	57,278	56,375	903	1 6	—	—
Sugar Beet	4,085	3,902	183	4 7	—	—
Carrots	10,026	11,688	—	—	1,662	14 2
Onions	3,958	4,780	—	—	822	17 2
Celery	5,336	5,486	—	—	150	2 7
Rhubarb	6,476	6,357	119	1 9	—	—
Chicory	93	391	—	—	298	76 2
Flax	641	792	—	—	151	19 1
Hops	35,676	34,829	847	2 4	—	—
Small Fruit	76,861	77,997	—	—	1,136	1 5
CLOVER and ROTATION GRASSES — For Hay	1,700,481	1,554,909	145,572	9 4	—	—
CLOVER and ROTATION GRASSES — Not for Hay	795,351	968,104	—	—	172,753	17 8
CLOVER and ROTATION GRASSES — TOTAL	2,495,832	2,523,013	—	—	27,181	1 1
OTHER CROPS	98,431	93,847	4,584	4 9	—	—
BARE FALLOW	387,832	273,725	114,107	41 7	—	—
ORCHARDS (*b*)	243,623	244,825	—	—	1,202	0 5

(*a*) Excluding Mountain and Heath Land used for grazing (3,806,599 acres in 1913, as compared with 3,774,655 acres in 1912)

(*b*) Any Crop or Grass grown in Orchards is also returned under its proper heading

LIVE STOCK.

CLASS.	1913.	1912.	INCREASE.		DECREASE.	
	No.	No	No	Per Cent.	No	Per Cent.
Horses used for Agricultural purposes (includ. Mares for Breeding)	807,316	906,223	—	—	98,907	10·9
Unbroken horses (includ. Stallions) — One year and above ..	227,933	234,898	—	—	6,965	3·0
Unbroken horses (includ. Stallions) — Under one year	105,854	106,882	—	—	1,028	1 0
Other Horses .	261,043	158,007	103,036	65 2	—	—
TOTAL OF HORSES . .	1,402,146	1,406,010	—	—	3,864	0·3
Cows and Heifers — In Milk.. .. .	1,707,478	1,848,936	—	—	141,458	7·7
Cows and Heifers — In Calf, but not in Milk .	556,925	498,983	57,942	11·6	—	—
Other Cattle —Two years & above	1,150,625	1,112,195	38,430	3 5	—	—
,, ,, One year & under two	1,160,635	1,239,517	—	—	78,882	6 4
,, ,, Under one year . .	1,141,281	1,142,089	—	—	808	0 1
TOTAL OF CATTLE .. .	5,716,944	5,841,720	—	—	124,776	2 1
Ewes kept for Breeding	6,699,291	7,148,109	—	—	448,818	6 3
Other Sheep:—One year & above	3,420,605	3,644,711	—	—	224,106	6 1
,, ,, Under one year ..	7,010,390	7,260,545	—	—	250,155	3·4
TOTAL OF SHEEP .	17,130,286	18,053,365	—	—	923,079	5 1
Sows kept for Breeding .	280,855	334,081	—	—	53,226	15 9
Other Pigs ..	1,821,047	2,162,589	—	—	341,542	15·8
TOTAL OF PIGS .	2,101,902	2,496,670	—	—	394,768	15 8

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for October, 1913, issued by the International Institute of Agriculture, shows the production of the cereal crops this year The countries for which it is possible to give an approximate estimate of the production are as follows:—In *Europe:* Prussia, Belgium, Denmark, Spain, France, England and Wales, Ireland, Hungary, Italy, Luxemburg, Netherlands, Rumania, Russia in Europe (63 governments), Switzerland; in *America:* Canada, United States; in *Asia:* India, Japan, Russia in Asia (10 governments); in *Africa:* Algeria (excluding the Department of Algiers), Tunis.

Wheat.—The total production for all the countries included this month is estimated at 409,536,000 qr., as compared with 392,983,000 qr. in 1912, the increase being equal to 4 2 per cent. The area planted was greater than in 1912 by 1 5 per cent.

Rye.—The estimated production in the above countries (excluding England and Wales, Ireland, India, Japan, Algeria, and Tunis) amounts to 187,281,000 qr., which shows practically no change from last year, when the production was 187,214,000 qr. The area under production exceeded that of 1912 by 1 7 per cent.

Barley.—The total production in the above-mentioned countries (with the exception of India) is placed at 152,023,000 qr., against 150,258,000 qr. last year, or an increase of 1 2 per cent., while the area increased by 5 5 per cent.

Oats.—The estimated production in all the countries named above (excluding India) shows a fall, as compared with last year, of 3·4 per cent., the total being 403,114,000 qr., as compared with 417,112,000 qr.

in 1912. The area planted, however, showed an increase of 2·7 per cent.

Maize.—The estimated total production in Spain, Hungary, Italy, Russia in Europe, Switzerland, Canada, United States, Japan, and Tunis is placed at 323,662,000 qr., which is considerably less than in 1912, when the production amounted to 411,169,000 qr., the decrease being equal to 21·3 per cent. The area under production was practically the same as last year.

The following supplementary notes are given :—

Austria.—The harvest of oats was in full swing at the beginning of October, the yield generally being good, and the quality satisfactory. The harvest of maize has begun in the warmest districts, but the majority is not yet ripe. The condition of the crop on October 1st promised a yield rather above the average.

Argentina.—The estimated area sown with wheat in 1913–14 shows a reduction of 4·2 per cent. as compared with 1912–13, the acreage being given as 16,364,000. The area of oats is estimated at 3,090,000 acres, an increase on the previous year of 4·9 per cent.

Australia.—The area under wheat in 1913–14 is placed at 8,929,000 acres, or 21·7 per cent. more than in 1912–13.

New Zealand.—The condition of the cereal crops on October 1st was about equal to the average.

Sugar Beet.—The total production in Prussia, Hungary, Belgium, Denmark, Spain, Italy, Netherlands, and Switzerland is estimated at 24,504,000 tons, as compared with 24,793,000 tons in 1912, the decrease amounting to 1·2 per cent.

France.—The Ministry of Agriculture estimated the condition of maize on October 1st at 63, of potatoes at 60, of hops at 60, and of apples and pears for cider and perry at 58 (80=good, 60=fairly good, 50=average). (*Journal Officiel,* France, October 15th.)

Italy.—The final official estimates of the production of the cereals are as follows :—Wheat, 26,793,000 qr., compared with 20,709,000 qr. in 1912; rye, 652,000 qr., compared with 616,000 qr.; barley, 1,296,000 qr., compared with 1,008,000 qr.; and oats, 4,457,000 qr., compared with 2,902,000 qr. The preliminary estimate for late-sown maize is 12,025,000 qr., against 11,020,000 qr. last year. (*Notizie Periodiche di Statistica Agraria,* September.)

Hungary.—The official report, relating to conditions on October 6th, gives the following estimates of production (the final estimates of 1912 in brackets) :—Maize, 22,662,000 qr. (20,609,000); potatoes, 4,814,000 tons (5,296,000); and sugar beet, 4,700,000 tons (4,719,000).

Russia.—According to the preliminary figures of the tax inspectors, the total yield in 1913 of all the cereals from the 231,263,000 acres sown in European Russia is estimated, on the basis of samples threshed, at 76,588,000 tons; of this quantity 29,927,000 tons consist of winter cereals, or 39·1 per cent. of the total yield. The crop is greater than that of last year by about 9,000,000 tons, or 13·4 per cent.; while, in comparison with the average of the last five years, it is still larger, viz., 15,000,000 tons, or 24·3 per cent. The surplus for export is estimated at 26,000,000 tons. (*Broomhall's Corn Trade News,* November 5th.)

An official bulletin giving the condition up to October 14th states that, on the whole, the condition of winter sowings is satisfactory. (*Ibid,* November 6th.)

Rumania.—The production of this year's cereals is officially estimated as follows (in quarters, and 1912 figures in brackets):—Wheat, 10,000,000 (10,600,000); barley, 3,100,000 (2,600,000); oats, 3,995,000 (2,436,000); and rye, 300,000 (400,000). The preliminary estimate of maize is 13,500,000 qr., compared with 10,000,000 qr. last year. (*Broomhall's Corn Trade News,* October 22nd and November 3rd.)

Canada.—A bulletin issued by the Census and Statistics Office at Ottawa, relating to conditions at the end of September, gives the following estimates of the yield of the cereals (in bushels):—Spring wheat, 188,468,000, compared with 182,840,000, the final estimate of 1912; winter wheat, 19,107,000, compared with 16,396,000; all wheat, 207,575,000, compared with 199,236,000; oats, 391,418,000, compared with 361,733,000; barley, 44,348,000, compared with 44,014,000; rye, 2,559,000; and maize for husking, 14,086,000. The average quality of the crops, 100 representing grain well headed, well filled, well saved, and unaffected to any appreciable extent by frost, rust, smut, &c., is as follows:—Spring wheat, 89·17; oats, 90·52; barley, 88·25; rye, 85·41; and maize for husking, 75·16. During September ideal weather for the ingathering of the grain crops prevailed all over Canada. In the greater part of Ontario and in the western provinces harvesting operations were well completed by the middle of September, and only in parts of Quebec and the Maritime Provinces, where the spring opens later, was harvesting carried on during the latter end of the month

Australia.—The *Monthly Summary of Australian Statistics* of July, 1913, issued by the Commonwealth Bureau of Census and Statistics, gives the following estimates of the production of the principal crops in the Commonwealth, in the season 1912–13 (1911–12 figures in brackets):—Wheat, 91,969,547 bushels (71,636,347); oats, 16,112,818 bushels (9,561,771); maize, 8,104,528 bushels (9,039,855); hay, 3,936,638 tons (2,868,032).

Hops.—*Germany*—The official estimate of this year's production of hops in Germany, published in the *Deutscher Reichsanzeiger* of October 11th, places the yield at 208,945 cwt., from an area of 66,809 acres, compared with 404,660 cwt. from 66,606 acres in 1912.

Russia.—H.M Consul at Warsaw, in a report dated October 15th, stated that the total production of hops in Russia was estimated at 51,600 cwt., or 90 per cent. of the average production, as compared with 58,320 cwt. last year.

Potatoes.—*Germany.*—H.M. Consul-General at Dusseldorf states that this year's potato crop is, generally speaking, considered good, as regards both quantity and quality, with the exception of a few cases in the east and south. The later varieties showed no sign of disease. It is generally considered that Germany will not have to import potatoes this season, but, on the contrary, will be able to export to some extent Prices will probably be lower this year than in 1912.

Agricultural Conditions in England and Wales on November 1st.

The reports furnished by the Crop Reporters of the Board on agricultural conditions in England and Wales indicate that October was very generally a favourable month for all kinds of farm work; nearly everywhere harvesting had been completed and good progress made with autumn cultivation; while roots and grasses had also benefited.

With a few exceptions in late districts, where the rain towards the end of September had interfered with the ingathering, the quality and condition of wheat are generally good, and the same may be said of barley in most parts of the country, but there are more complaints regarding oats; and of the latter especially it is frequently reported that they were stacked in damp condition, with consequent over-heating of ricks.

The bulk of the potatoes have now been lifted under favourable conditions. The quality is generally good: and, although reports of disease are not lacking from almost every district, there would seem to be much less than usual.

The mild open weather has favoured continuous growth of the roots; and while in a few counties mangolds have all been lifted, in many others farmers have been tempted to leave them in the ground so long as possible. Turnips and swedes have distinctly improved.

The weather has been very suitable for autumn cultivation, which is, upon the whole, more forward than usual (except in Wales). Wheat sowing is well advanced, and in some localities completed; where showing, the plant is quite healthy and satisfactory.

Seeds, like roots, have considerably improved during the month, and many districts where prospects were very poor a month ago are now more promising. In the north and west the plant is generally healthy and vigorous; but in the rest of England, where the summer was much drier, seeds are still below the average; a good many fields had suffered too much and have been ploughed up.

Live stock have generally done well during the month; there is plenty of grass in the pastures; and the outlook for the winter is generally satisfactory, the rather poor prospects for roots, and, in some cases, straw, being generally balanced by good yields of hay.

Labour has been rarely plentiful, and some scarcity is reported from most neighbourhoods; but the deficiency has nowhere been serious.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on November 1st, 1913, certain diseases of animals existed in the countries specified:—

Austria (for the period October 22nd—29th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 1,460 Höfe now infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period October 1st—15th).

Anthrax, Blackleg, Foot-and-Mouth Disease (301 outbreaks in 90 communes), Glanders and Farcy, Rabies.

Bulgaria (*for the period September 21st—29th*).
Anthrax, Glanders, Rabies, Sheep-pox.

Denmark (*month of September*).
Anthrax, Glanders and Farcy, Swine Erysipelas, Swine Fever.

France (*for the period October 12th—18th*).
Anthrax, Blackleg, Foot-and-Mouth Disease (2,570 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (*for the period October 1st—15th*).
Foot-and-Mouth Disease (111 infected places in 14 parishes), Glanders and Farcy, Swine Fever.

Holland (*month of September*).
Anthrax, Foot-and-Mouth Disease (one outbreak), Foot-rot, Swine Erysipelas.

Hungary (*for the period October 1st—8th*).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 1,525 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (*for the period October 13th—19th*).
Anthrax, Blackleg, Foot-and-Mouth Disease (2,856 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (*for the period June 1st—August 15th*).
Anthrax, Glanders and Farcy.

Norway (*month of September*).
Anthrax, Blackleg, Swine Fever.

Rumania (*for the period October 6th—13th*).
Anthrax, Dourine, Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (*month of June*).
Anthrax, Foot-and-Mouth Disease (13,478 animals in 201 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (no further returns received)

Spain (*month of August*)
Anthrax, Blackleg, Foot-and-Mouth Disease (1,895 animals), Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (*month of September*).
Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (*for the period October 22nd—26th*).
Anthrax, Blackleg, Foot-and-Mouth Disease (1,106 "étables" and Alpine-Pâturages entailing 14,902 animals, of which 195 "étables" and Alpine-Pâturages were declared infected during the period), Swine Fever.

Agricultural Labour in England during October.

The supply of agricultural labour in England during October was, according to statements in the Monthly Agricultural Report (November 1st), sufficient for requirements as a rule, though it was hardly ever plentiful. Labour was reported to be rather short in *Salop, Stafford, Derby, Nottingham, Leicester,* and *Rutland.* There was some scarcity of casual labour in *Buckingham, Oxford, Berkshire,* Mid-*Worcester,* and north-east *Cheshire.*

Temporary labour was sometimes difficult to get for harvesting in the northern counties, and in *Norfolk* and parts of *Lincolnshire.* Stockmen were scarce in south-east *Durham,* north-west *Gloucester,* and east *Hereford,* and good horsemen and shepherds were wanted in south *Cambridge.* Female farm servants were scarce in west *Devon.* In north *Lancashire* there were fewer Irishmen available for potato lifting than usual. In south-west *Cumberland* some reduction of wages was expected at Martinmas, as compared with the high rates of last summer.

THE CORN MARKETS IN OCTOBER.

C. KAINS-JACKSON

British Wheat.—Supplies at market have not been large, and the returns of the area cultivated have led to a reduction in the estimates of the yield. Farmers speak well of weight, and samples of 63 to 64 lb. to the bushel are fairly common. Condition varies greatly. The Burgoyne's Fife and Red Standard, which won at Dorchester Show, left scarcely anything to desire, and Mark Lane has throughout the month provided adequate supplies of fine seed corn for those who would pay the not unreasonable prices demanded. At the same time there are far more uneven samples than the favourable weather for harvesting would have led one to expect. Experts find on examination of this autumn's samples that irregular and imperfect ripening appears to be the cause of the trouble in a great many instances. Prices show a decline on the year, and also on the month, but they have continued above thirty shillings. Exceptionally low prices in the far north and in East Anglia have had their counterpoise in fair to good averages in the west, as well as in Kent, Surrey, and Middlesex. The range of prices may be given about as follows:—Chicken, 448 lb., 27*s.* locally, 28*s.* 6*d.* on Mark Lane; common red, 30*s.* to 35*s.* per 504 lb.; white, 32*s.* to 37*s.*; seed corn, 37*s.* to 42*s.*; Revitts, a distinct type of wheat, shows good value and weight this year, and fetches 32*s.* to 33*s.* per quarter.

Colonial and Indian Wheat.—Forced sales of Canadian have been the chief feature of this branch of the market, and the prices accepted have undermined the selling value of all other sorts at the great exchanges. The Canadian crop is a good one, but the current estimate of two million quarters increase on the previous season did not prepare the trade for the rush to sell. Russia, for example, has much more than a two millions increase on 1912, but is not by any means anxious for prompt sales. Yet operators in England had sound reason

to regard the Canadian farmer as a firmer holder than the Russian. October closed with Canadian wheat offered at 35*s.* per 480 lb for best, 33*s.* 9*d.* for No. 2, 32*s.* 6*d.* for No. 3, 31*s.* 6*d.* for No. 4, and 28*s.* for feed corn. Indian wheat has declined about 1*s.* on the month, but the Australian remaining unsold is held stiffly, and 37*s.* 6*d.* is asked, where 38*s.* was the price a month ago.

Foreign Wheat.—In view of Canada's production farmers of the United States have had to accept seven shillings per cental for cargoes of average quality red winter. Nor can they often get more for the spring-sown wheat, as it is with that sort that Manitoba and Saskatchewan more directly compete. The Russian trade shows a wide range; 32*s.* to 36*s.* covers most transactions. A long and indecisive conference has been held in London with reference to the unsatisfactory way in which Russian wheat is shipped. The Russian delegates admitted impurities to an extent of from 5 to 12 per cent., but denied that impurities were deliberately added to consignments received from farmers in a pure state. Meanwhile the English market buys most other sorts of wheat in preference to Russian. South-Eastern Europe has done an increased export trade, and has accepted moderate prices in order to facilitate sales. Argentine wheat has not changed much in price, but the prospects of new crop shipments in January at 33*s.* per 480 lb. have exercised a weakening influence on the spot market.

Wheat Supplies and Shipments.—Imports were by no means heavy, and there was not a large supply on passage on the 31st. Shipments for October were.—1,835,000 qr. from North America; 124,000 qr. from South America; 2,625,000 qr. from Russia; 616,000 qr. from Europe S.E.; 284,000 qr. from India; and 111,000 qr. from Australasia. The North American consisted mostly of Canadian spring and U S winter, and the South American was exclusively Argentine. Of the 2,625,000 qr. shipped by Russia, England only bought 115,000 qr.

Flour.—Flour has been a weak and bad market, except for good grade flour made from American winter wheat, which has to some extent hardened On the last day of the month Mark Lane was sometimes 6*d.* cheaper for Household flour—29*s.* 6*d.* for Town Whites, 26*s.* 6*d.* for Town Households, and 25*s* for No. 2 ex mill. The general market, however, was no cheaper, and millers urged that with bran and middlings, sharps and pollards, so very cheap, they could not afford to take less money than at Michaelmas. Imported flour ranged from 28*s.* for finest American and Canadian down to 24*s.* for the poorest red American. The bulk of the business done during October was at a price very close to 26*s.* This price also commanded Country Patents, while 24*s.* was accepted for Roller Whites, and 23*s.* for Stone-made. A good mixture of English Roller Whites and American ordinary Patent could be sold for 25*s.* to 25*s.* 3*d.* per sack. North America in October shipped 618,000 sacks, and there were 235,000 sacks on passage on the last day of the month.

Barley.—Splendid samples of new malting barley were shown at the great Dorchester Barley Market on October 15th, and since that date fine lots have been in evidence at Mark Lane and elsewhere in very fair proportion to total deliveries. At the same time, rather disappointing averages have been recorded. There is a wider gap than usual between

fine and common barley this season, and the amount of grain which has suffered from the weather, despite a fine harvest period, is extraordinary. Prices exceed 40*s*. for finest English, Hungarian, and Bohemian. No Bavarian Saale or Chilian seems obtainable. The medium good types come at 32*s*. to 34*s*. for English, 30*s*. to 32*s*. for Ouchak, and 32*s*. to 34*s*. for Danish, and also for Tunis, which is a good sample this autumn. Feeding barley ranges from 19*s*. 6*d*. for Persian, 20*s*. for Russian, and 23*s*. for Argentine, through 26*s*. for Indian, and 27*s*. for Moldavian, up to 28*s*. for robust but discoloured samples of the home crop. The chief price change is the 1*s*. 6*d*. decline in Russian, the results of the arrivals of that type at our ports being extremely heavy week after week, and of there being 550,000 qr. of that one sort on the high seas, out of 800,000 qr. of all barley on passage. The barley shipments of October were 3,150,000 qr. from Russia, 153,000 qr. from America, 236,000 qr. from Europe S.E , and 80,000 qr. from India. The Russian total seems to be the largest for October, but is far from being an absolute record. September shipped 3,780,000 qr., and in September, 1911, the record of 4,361,000 qr. was achieved. There were barley shipments in October from Anatolia, Syria, Tunis, Algeria, and Persia, but no statistics are available

Oats.—The English averages have included some very low quotations, but a desire to clear poor samples has been general, and it is expected that the heavy oats of the 1913 crop will be well held. A small yield on a diminished area points to firm holding as sound policy, especially as there are only 150,000 qr. of foreign on passage, and our own Colonies are hardly shipping. The American crop deficiency is put at a very high figure—something like 20 per cent.—and Russia in October only shipped 308,000 qr , as compared with 655,000 qr., 726,000 qr., and 1,118,000 qr in the three previous Octobers. No other country shipped any material quantity of oats, but La Plata is depressing the trade by free offers to ship new oats in January at 14*s*. 6*d*. c f i to London.

Maize—The market for maize futures collapsed as October went on, and as this is a trade in a purely foreign product with no base in a home crop to steady it, the effect was almost immediately registered on the spot markets. As these were incommoded by arrivals in excess of what the mild weather "justified" or allowed of being sold, value fell as low as 4*s*. 9*d*. per cental. There were then 1,500,000 qr. on passage, but the total is now declining somewhat rapidly. The shipments of October were 1,900,000 qr. from South America, 150,000 qr. from Russia, and 101,000 qr. from Europe S.E.

Oilseeds.—Linseed remains cheap. Prices are about 55*s*. for English, 50*s*. for Russian, 47*s*. for Indian, 46*s*. for New Zealand, and 45*s*. for Argentine, Canadian, and American. There is a sound sale for ground linseed cake at eight guineas per ton. Cottonseed is cheaper on the month, as the new Egyptian crop is now well in evidence. There were 51,000 tons on passage, against 35,000 tons a year ago.

Various.—A steady trade has been doing in beans, peas, and tares, and as the yields are thought to be smallish, and are now discovered to be on a reduced area also, the market is expected to harden. Beet sugar remains cheap, and the reports of Continental yields are regarded

as promising a continuance of moderate buying prices. Mustard seed has fallen off a little in price. Russian buckwheat is rather neglected, much of it being very inferior, but good new French is to hand at 33*s*. per 416 lb., and has buyers. A good sale of English red clover-seed is reported, as the quality is fine, the yield large, and the price temptingly low.

THE LIVE AND DEAD MEAT TRADE IN OCTOBER.

A. T. MATTHEWS

Fat Cattle.—The copious rains and mild temperature which have prevailed have been productive of abundance of grass in the pastures, and this has greatly assisted in maintaining fair condition in the market supplies, while as regards numbers there has been little to complain of. A feature of the month has been an increase in the supplies at Islington, and the relatively good prices obtained there for cattle of good quality, as represented by the Herefords and Devons. The demand for beef has been good, and prices compare very well with those at corresponding periods in 1912 and 1911, being slightly higher.

In the English and Welsh markets held in October the average values of the various breeds were as follows:—Shorthorns, 8*s* 9*d* and 8*s*. per 14-lb. stone for first and second quality, against 8*s*. 8*d*. and 7*s*. 11*d*. in September; Herefords, 8*s*. 10*d*. and 8*s*. 2*d*., against 9*s*. 2*d*. and 8*s*. 5*d*.; Devons, 9*s*. 3*d*. and 8*s*. 2*d*., against 9*s*. and 8*s*. 2*d*.; Welsh, 8*s*. 5*d*. and 8*s*., against 8*s*. 6*d*. and 7*s*. 11*d*; Polled Scots, 9*s*. and 8*s*. 9*d*., against 8*s*. 9*d*. and 8*s*. 7*d*. per stone Very few Polled Scots of first quality have been offering in the English markets. Shorthorns varied widely in value per stone at different centres, and very high prices have been given for stall-fed bullocks at Ipswich and Norwich, while Bristol and the great Lancashire markets appear to have been very poorly supplied as regards quality.

Veal Calves.—The value of veal calves has again been well maintained at an average of 9*d*. and 8*d*. per lb for first and second quality, and the superior prices obtained in comparison with those of a year ago suggest that more calves are being saved for rearing.

Fat Sheep.—The decrease in the total number of sheep in the country, as shown by the preliminary returns, will go far to explain the short supplies at market and the consequent advance in values. There is, however, a keen demand for breeding ewes and store lambs, indicating a tendency to increase the breeding flocks at the expense of the number exposed in the fat-stock markets. The supplies at the Metropolitan Market have been far below the average, and prices there have been relatively high There was a remarkably dear market at Hull in the third week, when Longwool wethers fetched 10½*d*. per lb.

In twenty-three leading English markets, Downs averaged 9¼*d*. per lb. for first, 8¾*d*. for second, and 6¾*d*. for third quality, against 8¾*d*, 8*d*., and 6½*d*. in September; Longwools in sixteen markets averaged 8¾*d*., 7¾*d*, and 6¼*d*., against 8¼*d*., 7½*d*., and 6*d*.; prime Cheviots averaged 9¼*d*., against 9*d*.; and prime Cross-breds 9½*d*., against

8¾*d.* This represents a general advance of ½*d.* per lb. on the month in all classes Fat lambs were no longer officially quoted, but a few pens of Scotch lambs on offer sold at about 10½*d.* per lb. Islington Market has been fairly well supplied with prime Hampshire tegs, as they are now called, and these are always appreciated by the butchers of the London district, and sell at the extreme prices for small mutton.

Fat Pigs.—The trade for bacon pigs has continued firm on the whole. Occasional spells of hot weather slightly checked the trade and slightly affected prices, and the average in English and Welsh markets was 8*s.* 6*d.* and 8*s.* for first and second quality, against 8*s.* 7*d.* and 8*s.* 1*d.* in September

Carcass Beef—British.—For the London dead-meat market home-killed beef was a slow trade all the month, particularly in the last week, when it was found difficult to clear even the choicest Scotch. Prices tended downward towards the end of the month, and showed a slight average decline on September prices. Scotch short sides averaged 4*s.* 10*d.* and 4*s.* 7*d* for first and second quality; long sides, 4*s.* 6*d* and 4*s.* 3*d.*; English, 4*s* 2*d.* and 4*s.*; and Irish, 4*s.* and 3*s.* 10*d.* per 8-lb. stone.

Canadian Beef.—There has still been an occasional arrival of Canadian beef from Deptford, but the trade is quite unimportant. It has made very similar prices to those of Irish.

Chilled Beef.—This trade was, as usual, rather irregular, but, on the whole, Argentine chilled hindquarters made about 2*d.* per stone more than in September, averaging 3*s.* 8*d.* and 3*s* 5*d.* for first and second quality respectively. Arrivals have been moderate, and in the third week the best hinds touched 4*s.* per stone. Forequarters were also dearer, averaging 2*s.* 4*d.* and 2*s.* 2*d.*, against 2*s.* 3*d.* and 2*s.* per stone last month.

Frozen Beef.—In view of the improvement in chilled beef, holders of frozen were enabled to raise their prices The advance amounted to 3*d.* per stone, and 3*s.* was occasionally touched for hindquarters, while in the last week forequarters were worth 2*s.* to 2*s.* 3*d.* per stone.

Carcass Mutton—Fresh Killed.—The mutton trade in London was dull, and even the choicest Scotch was only in moderate request. Supplies, however, were not excessive, and there was an average advance of nearly ½*d.* per lb. for Scotch and ¼*d.* for English. The former averaged 5*s.* 3*d.* and 4*s.* 11*d.*, and the latter 4*s.* 9*d.* and 4*s.* 5*d.* per stone. British lamb is no longer quoted. There have been regular supplies of Dutch, and this, except during unfavourable weather, has realised rather more than English in London, the best tegs making 5*s.* per stone.

Frozen Mutton.—The demand for New Zealand mutton was steady, and prices were virtually the same as in September. The average was about 3*s.* 1*d.* and 2*s.* 7*d.* per stone for first and second quality. Argentine mutton fetched 2*d.* to 3*d.* per stone less than New Zealand, but rather more than Australian, the last having been in small supply.

Frozen Lamb.—New Zealand lamb was not quite so dear, the decline on the month being ¼*d.* per lb. The average was 3*s.* 10*d.* and 3*s.* 5*d.* per stone for first and second quality. Some new season Australian in the last week made as much as New Zealand.

Veal.—The veal trade has been irregular, with prices fluctuating from week to week. The best English has ranged from 5*s.* 4*d.* to 6*s.* per 8 lb., while prime Dutch has occasionally made as much as 6*s.* 4*d.* By far the larger number of carcasses offered in London are those of very young calves, worth about 3*s.* 8*d.* per stone.

Pork.—There has been a good, seasonable demand for pork, which has been met by fairly adequate supplies. The best small English has fluctuated between 5*s.* and 5*s.* 4*d.* per stone, and Dutch sold at about 4*d.* per stone less.

THE PROVISION TRADE IN OCTOBER.

HEDLEY STEVENS.

Bacon.—The month of October has proved to be a trying one for dealers, there having been a steady decline in prices of Continental long sides from the first week of the month.

During September prices were exceptionally high, which presumably increased the killing of pigs, more especially in Denmark, and in consequence arrivals were large, and agents could not effect sufficient sales to prevent an accumulation of stock in London. By the third week, therefore, that port held a record stock of Danish sides, and further reductions were made in prices, showing a drop by the end of the month of from 10*s.* to 12*s.* per cwt. It is thought by many that still lower prices may prevail during November.

This drop in prices of Continental imports affected the prices of all other descriptions of bacon and hams, but American the least, as shipments from that country continue small, on account of the high prices prevailing for American hogs, and the continued good consumption of hog products in the States, so that there is no accumulation of stock in the cellars of the American packers.

American cables report that the breeders are losing a large number of young hogs from cholera, and in consequence they expect smaller receipts at the packing centres and higher prices during the winter months.

At Chicago during the month prices for hogs have ranged from \$7.50 to \$9.00, against \$7 10 to \$9.35 last year, and \$5.70 to \$6.80 two years ago.

English pigs have been marketed more freely, but through having to meet the competition of lower-priced foreign imports, English curers have had to reduce their prices for the raw material.

Cheese.—The month's trading has been unsatisfactory. Prices have not shown much change, as the retailers continue to show lack of confidence in future prices, and operate sparingly, their purchases being of a hand-to-mouth character

These conditions are caused by the high prices prevailing for imported cheese, though these are near those current at the same time last year, but retailers fear that the expected large arrivals from New Zealand will more than counterbalance the smaller arrivals from Canada, and consequently lower prices would have to be accepted to induce a freer consumption of cheese, and clearance of the New Zealand as it arrives.

Up to the end of October the imports of New Zealand cheese this year were 75,499 crates (say 151,000 cheese) in excess of the same period last year, and it is asserted by some that the quantity from that Colony will continue to increase.

For the Canadian season commencing May 1st the shortage in the shipments to the end of October was about 170,000 cheese, and 263,000 compared with the same period of 1911. The reduction of the American tariff has also affected the Canadian market for this article of food, but not to the same extent as butter.

During the month of October the weather in Canada has been such as to keep up average conditions for the flow of milk, but a large quantity of cream has been shipped into the States, and the make of cheese is reported to have been less

Estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 306,000, against 351,000 at the same time last year, and 340,000 two years ago.

Estimated stocks of New Zealand cheese in London and Bristol were 200 crates (two cheese in each), against 70 last year, and none two years ago.

English cheese continues in favour on account of the high prices of Colonial imports, and prices are slightly better. In comparison with last year, current prices are several shillings higher, although Canadians are being sold within 1*s.* to 2*s.* per cwt. of last year. Stocks are said to be less.

Butter.—There has been a good demand for best selections of butter throughout the month, and prices have had a hardening tendency for that description on account of scarcity.

Inferior grades continue to sell slowly, in spite of the lower prices which dealers are willing to accept to reduce their holdings, but with colder weather the consumptive demand for this kind ought to increase.

The arrivals from the Argentine have been delayed through floods interfering with free transit. The arrivals from Australia of the choicest brands have been speedily cleared, and the shipments now on passage will doubtless find ready buyers on arrival. Recent cable advices report good rains in Victoria and New South Wales, which should considerably increase the shipments to this country during November.

The first arrivals from New Zealand are due early in November, and will be wanted at full prices, say about 130*s.* per cwt. Advices from that country report a large make in progress.

The alteration in the United States tariff has diverted to that country, butter which was formerly sent to England. Shipments of Siberian have already gone into New York, and American buyers have been purchasing in Montreal stored lots of summer-made goods which usually served the western parts of Canada during the winter months, but Vancouver merchants have filled a portion of their winter requirements by contracting for New Zealand butter to be shipped direct to Vancouver.

Best Irish creamery butter has made good prices during the month, and readily cleared.

PRICES OF AGRICULTURAL PRODUCE

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in October and September, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description	October First Quality.	October Second Quality.	September. First Quality.	September. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots .	9 0	8 9	8 9	8 7
Herefords .	8 11	8 2	9 2	8 5
Shorthorns .	8 9	8 0	8 8	7 11
Devons	9 3	8 2	9 0	8 2
Welsh Runts .	8 5	8 0	8 6	7 11
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d	d.	d.
Veal Calves . .	9	8	9	8
Sheep:—				
Downs	9¼	8½	8¾	8
Longwools . .	8¾	7¾	8¼	7¼
Cheviots ..	9½	8½	9	8¼
Blackfaced . .	9	8	8¼	7¾
Welsh	8¾	7½	8	7¼
Cross-breds	9¼	8¼	8¾	7¾
	per stone *	per stone.*	per stone *	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs ...	8 6	8 0	8 7	8 1
Porkers	9 0	8 6	9 0	8 6
LEAN STOCK:—	per head	per head	per head	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk .	24 10	20 8	24 0	19 16
,, —Calvers .	22 19	19 0	22 16	19 8
Other Breeds—In Milk ...	21 13	17 11	20 12	18 2
,, —Calvers ..	16 15	14 5	15 16	14 17
Calves for Rearing	2 10	1 17	2 10	1 18
Store Cattle:—				
Shorthorns—Yearlings	10 16	9 6	10 10	9 3
,, —Two-year-olds	15 6	13 3	14 19	13 2
,, —Three-year-olds	18 17	16 3	18 15	15 16
Herefords —Two-year-olds	17 9	15 6	16 16	14 14
Devons— ,,	15 6	13 9	15 2	13 1
Welsh Runts— ,,	15 0	12 16	14 9	13 8
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	40 2	33 11	35 10	30 6
Store Pigs:—				
8 to 12 weeks old	26 9	20 10	28 8	23 4
12 to 16 weeks old	37 1	29 0	38 0	30 6

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in October, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham. s.	Birmingham. d.	Leeds. s.	Leeds. d.	Liverpool. s.	Liverpool. d.	London. s.	London. d.	Manchester. s.	Manchester. d.
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
BEEF :—											
English	1st	56	0	54	6	53	6	59	0	53	0
	2nd	53	6	52	6	50	6	56	0	49	6
Cow and Bull	1st	50	6	50	6	47	0	46	6	47	6
	2nd	44	6	46	6	42	0	42	0	43	0
Irish: Port killed	1st	53	6	52	6	53	6	56	6	—	
	2nd	46	6	50	0	50	0	54	0	—	
Argentine Frozen—											
Hind Quarters	1st	42	0	42	6	41	6	40	0	41	6
Fore ,, ...	1st	32	6	32	6	31	6	28	6	31	6
Argentine Chilled—											
Hind Quarters	1st	51	6	50	6	49	0	51	6	49	0
Fore ,, . . .	1st	33	0	32	0	31	0	33	0	31	0
Australian Frozen—											
Hind Quarters	1st	40	6	39	6	38	6	40	0	38	6
Fore ,, ...	1st	32	6	32	0	30	0	28	6	30	0
VEAL :—											
British	1st	—		68	0	80	0	78	6	78	0
	2nd	70	0	63	6	70	0	69	0	73	6
Foreign ...	1st	—		—		—		83	0	—	
MUTTON :—											
Scotch	1st	—		—		—		73	6	74	0
	2nd	—		—		—		69	0	69	0
English	1st	71	6	75	0	72	0	66	6	72	0
	2nd	62	0	71	0	67	0	62	0	66	6
Irish: Port killed	1st	70	0	—		72	0	—		—	
	2nd	51	6	—		67	0	—		—	
Argentine Frozen	1st	41	6	42	0	39	6	41	0	39	6
Australian ,, ...	1st	39	6	38	6	37	6	37	6	37	6
New Zealand ,, ...	1st	—		—		—		43	0	—	
LAMB :—											
British	1st	72	6	73	6	75	0	72	6	74	6
	2nd	68	6	70	6	70	0	67	6	69	0
New Zealand	1st	56	0	54	6	50	6	54	0	50	6
Australian	1st	51	6	46	6	45	6	47	0	45	6
Argentine	1st	49	6	49	6	46	6	42	0	46	6
PORK :—											
British	1st	77	6	74	0	76	0	72	0	77	0
	2nd	72	0	70	6	69	6	66	6	72	6
Foreign	1st	—		—		—		67	0	—	

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913.

Weeks ended (in 1913).	WHEAT. 1911.	WHEAT. 1912.	WHEAT. 1913.	BARLEY. 1911.	BARLEY. 1912.	BARLEY. 1913.	OATS. 1911.	OATS. 1912.	OATS. 1913.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Jan. 4	30 5	33 2	30 5	23 11	33 3	28 6	17 0	20 7	19 10
,, 11...	30 8	33 1	30 3	23 10	33 0	28 4	17 2	20 8	19 2
,, 18...	30 11	33 4	30 5	24 4	33 3	28 6	17 4	20 11	19 4
,, 25...	30 11	33 7	30 11	24 5	33 1	28 10	17 3	21 1	19 4
Feb. 1	30 9	33 8	31 1	24 5	32 10	28 11	17 5	21 3	20 2
,, 8 .	30 5	34 0	31 0	24 6	33 2	28 10	17 5	21 4	20 1
,, 15...	30 3	34 4	30 9	24 7	32 10	29 1	17 6	21 7	20 2
,, 22...	30 2	34 6	30 11	24 9	32 8	28 8	17 7	21 9	20 7
Mar. 1...	30 0	34 1	31 0	25 0	32 0	28 6	17 5	21 6	20 4
,, 8...	30 1	34 1	31 3	25 0	31 7	28 5	17 5	21 8	20 0
,, 15...	30 1	34 0	31 1	24 11	31 2	27 11	17 6	21 8	20 2
,, 22...	30 2	34 1	31 1	25 0	31 10	28 6	17 5	21 9	19 11
,, 29..	30 3	34 4	31 3	24 11	30 3	27 6	17 5	21 8	19 7
Apl. 5	30 4	34 10	31 4	24 7	30 9	27 0	17 7	21 11	19 2
,, 12..	30 3	35 4	31 3	25 2	30 2	27 8	18 3	22 1	19 2
,, 19	30 4	36 7	31 6	25 5	29 11	26 11	17 10	22 4	18 10
,, 26...	30 11	37 10	31 8	25 5	30 4	26 7	18 3	22 9	19 3
May 3...	31 4	38 1	32 2	25 7	30 2	25 11	18 6	23 1	19 6
,, 10...	31 8	37 11	32 6	25 1	31 1	25 9	19 0	23 7	19 6
,, 17.	32 6	37 8	32 10	25 4	31 2	25 4	19 2	23 7	19 9
,, 24...	32 8	37 2	32 10	25 0	31 1	25 3	19 5	23 7	19 11
,, 31...	32 5	36 10	32 7	24 10	30 0	26 1	19 5	23 9	20 1
June 7...	32 4	36 11	32 10	25 7	29 11	26 2	19 7	24 0	19 8
,, 14...	32 3	37 0	32 8	23 11	30 8	24 7	19 8	23 10	20 2
,, 21...	31 11	37 5	32 8	23 9	30 8	23 10	19 10	24 0	19 8
,, 28...	31 10	37 10	32 8	24 5	30 2	24 3	19 9	23 11	19 1
July 5	32 1	38 2	33 1	25 10	31 7	25 2	19 9	23 11	21 0
,, 12...	32 3	38 3	33 4	25 10	30 2	25 10	19 11	24 1	19 4
,, 19...	32 5	38 10	33 6	24 3	30 9	24 9	19 5	24 8	20 5
,, 26...	32 5	38 9	33 10	23 8	30 9	24 1	19 7	23 4	20 8
Aug. 2.	32 0	38 4	34 1	24 4	28 6	24 5	18 2	22 2	20 3
,, 9...	31 6	39 2	34 1	26 9	30 7	24 9	18 0	22 4	19 0
,, 16..	31 6	38 2	34 3	27 8	28 3	24 7	17 10	21 8	18 7
,, 23 .	31 8	35 6	33 7	28 10	28 1	26 5	18 0	20 10	18 8
,, 30...	31 7	34 10	32 7	28 4	28 6	29 0	18 3	20 8	17 10
Sept. 6.	31 10	35 1	31 11	28 4	29 9	30 11	18 1	21 8	17 8
,, 13..	32 0	33 5	31 9	29 0	29 0	31 5	18 5	20 5	18 0
,, 20 .	32 4	32 7	31 7	29 11	29 6	30 9	18 9	19 10	17 11
,, 27 .	32 6	31 7	31 6	30 5	29 9	30 1	19 1	19 5	17 9
Oct. 4 .	32 7	31 8	31 3	30 9	29 7	29 9	19 5	19 8	17 10
,, 11	32 9	31 10	31 0	31 0	30 4	29 1	19 10	19 5	17 10
,, 18...	32 9	32 2	30 11	31 5	30 11	28 8	19 11	19 9	17 9
,, 25 .	33 1	33 1	30 7	31 7	31 6	28 7	20 6	19 10	18 0
Nov. 1...	33 4	33 4	30 1	31 10	31 10	28 2	20 8	20 1	17 9
,, 8 .	33 4	33 1	30 0	32 7	31 11	28 1	20 11	19 11	17 9
,, 15...	33 1	32 10		32 10	31 2		21 0	19 9	
,, 22 .	33 0	32 1		33 5	30 11		20 10	19 11	
,, 29 .	32 10	31 9		33 10	30 8		20 11	19 8	
Dec. 6...	32 9	31 0		34 0	29 11		20 9	19 6	
,, 13..	32 11	30 8		33 5	29 2		20 9	19 3	
,, 20...	32 9	30 7		33 5	28 11		20 8	19 1	
,, 27...	33 0	29 10		33 4	28 6		20 7	19 2	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1912.	1913.	1912.	1913.	1912.	1913.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	September	45 7	46 7	29 11	29 5	23 2	23 0
	October	46 6	45 9	30 0	28 11	23 6	22 7
Paris:	September	47 2	47 9	30 10	30 6	22 7	23 2
	October	48 7	45 7	30 10	30 2	24 7	22 4
Belgium:	August	36 5	36 2	28 10	26 3	25 3	23 9
	September	35 7	32 10	30 0	26 4	25 7	20 9
Berlin:	August	45 4	42 9	—	—	25 1	22 10
	September	45 11	42 6	—	—	25 2	22 5
Breslau:	August	41 6	42 4	31 2* 29 4†	27 8* 25 10†	25 9	21 10
	September	39 10	41 9	31 10* 28 11†	27 8* 25 7†	27 3	21 9

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of October, 1912 and 1913.

—	Wheat.		Barley.		Oats.	
	1912.	1913.	1912.	1913	1912.	1913.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London	34 2	32 4	31 7	28 11	21 4	19 0
Norwich ...	33 2	31 3	28 9	27 10	19 10	17 4
Peterborough ...	29 7	29 10	29 5	29 0	18 4	17 4
Lincoln...	29 9	30 2	30 6	29 7	20 9	18 6
Doncaster	29 6	29 9	28 11	27 7	19 9	18 0
Salisbury	34 6	30 8	31 5	29 0	20 4	18 1

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in October, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol. First Quality.	Bristol. Second Quality.	Liverpool. First Quality.	Liverpool. Second Quality.	London. First Quality.	London. Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb	per 12 lb.	per 12 lb.	per 12 lb.
British	14 0	13 0	—	—	14 6	13 6
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	124 0	116 0	124 0	122 0	124 6	120 0
,, Factory ..	108 0	98 0	107 0	97 0	109 6	105 6
Danish . .	—	—	135 0	133 0	135 0	132 6
French . .	—	—	—	—	127 6	122 6
Russian	109 0	103 6	107 6	103 0	109 0	105 0
Australian	119 0	111 0	—	—	119 6	114 0
New Zealand .	—	—	—	—	—	—
Argentine .. .	122 0	120 0	—	—	121 0	118 0
CHEESE :—						
British—						
Cheddar	77 0	73 0	75 6	73 0	84 6	76 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	72 6	67 0	78 6	74 0
			per cwt.	per cwt.	per cwt.	per cwt
Canadian	66 0	64 0	65 6	63 0	66 6	65 0
BACON :—						
Irish (Green) ...	81 0	76 0	79 0	75 6	81 0	78 6
Canadian (Green sides)	76 0	74 0	75 6	73 6	77 6	76 0
HAMS :—						
Cumberland (Dried or Smoked) ..	—	—	—	—	135 0	126 6
Irish (Dried or Smoked)	—	—	—	—	119 0	112 0
American (Green) (long cut) ...	73 6	71 0	70 6	67 0	79 0	76 6
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	17 1	15 10
Irish . ..	13 9	12 8	13 0	11 8	14 6	13 1
Danish	—	—	12 7	12 2	14 2	13 2
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
British Queen ...	80 0	73 6	55 0	50 0	71 0	61 0
Edward VII. ...	85 0	78 6	55 0	50 0	73 0	61 0
Up-to-Date .	80 0	70 0	55 6	48 6	72 0	62 6
HAY :—						
Clover	—	—	91 0	70 0	90 0	84 0
Meadow	—	—	—	—	81 0	74 6

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER	
	1913	1912.	1913.	1912.
Anthrax :—				
Outbreaks	41	45	452	639
Animals attacked ...	47	46	500	721
Foot-and-Mouth Disease :—				
Outbreaks	—	1	—	82
Animals attacked	—	6	—	639
Glanders (including Farcy) :—				
Outbreaks	4	9	126	148
Animals attacked	8	15	312	271
Parasitic Mange :—				
Outbreaks	76	65	2,079	2,480
Animals attacked	112	96	4,115	5,285
Sheep-Scab :—				
Outbreaks	7	9	141	186
Swine-Fever :—				
Outbreaks	180	134	2,048	2,479
Swine Slaughtered as diseased or exposed to infection ...	1,953	2,500	26,940	33,497
Tuberculosis :—				
Number of Premises notified	602	—	*3,211	—
Number of bovine animals notified as for slaughter	655	—	*3,513	—

* Since 1st May, when the Tuberculosis Order came into operation.

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER.	
	1913	1912.	1913.	1912.
Anthrax :—				
Outbreaks ...	—	—	—	3
Animals attacked	—	—	—	3
Foot-and-Mouth Disease :—				
Outbreaks	—	36	—	65
Animals attacked	—	93	—	356
Glanders (including Farcy) :—				
Outbreaks ..	—	—	—	—
Animals attacked ..	—	—	—	—
Parasitic Mange :—				
Outbreaks	7	4	109	57
Sheep-Scab :—				
Outbreaks	29	19	423	285
Swine-Fever :—				
Outbreaks	10	8	127	194
Swine Slaughtered as diseased or exposed to infection ...	56	64	769	1,581

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HIGHER EDUCATION IN AGRICULTURE, VETERINARY SCIENCE, FORESTRY, AND HORTICULTURE IN PRUSSIA.

THE various branches of lower agricultural education in Prussia were described in a previous article,* and attention was then directed to the fact that the existence of an educational ladder which would connect the lower branches of agricultural education with the higher must not be assumed, as such a ladder does not, in fact, exist. It will be advisable, therefore, to explain how the students of the various Higher Agricultural Institutions are recruited.

Higher Agricultural Education.

In the ordinary course, a student who wishes to enter an Agricultural Institute which forms part of a University must produce the same certificates and proceed in the same way as if he were entering any of the ordinary faculties of a University; that is to say, he must show that he has been educated at a recognised Secondary School—either a *Gymnasium*, a *Realgymnasium*, or an *Oberrealschule*. He must show, further, that while at that school he spent a certain time in the top form—that is, the form corresponding to the sixth form in an English school—and that he has been successful in negotiating the leaving examination which takes the place in some degree of an English Matriculation Examination. This leaving examination seems to the Englishman who is familiar with the easy Matriculation Examinations of some English Universities to be stiff, and there is no doubt that the average German schoolboy in the upper forms has to work harder than the corresponding

* *Journal*, April, 1913.

English boy; the difficulty of this leaving examination is alleviated by the fact that the examiners are often the masters under whom the boys have worked. The important point to notice is that a long attendance at a Secondary School is necessary in the ordinary course to qualify a pupil to become an undergraduate. For any young man who has not had this advantage the difficulties standing in his way are very great. Foreigners are admitted to these University Institutions under much simpler conditions, but always on the understanding that they do not intend to apply for a civil appointment under the Prussian Government.

While what has been stated above applies to all the Prussian Universities which have Agricultural Institutes attached to them or which provide agricultural courses, and to all students who wish to take a University degree in an agricultural subject, there are certain other possibilities. It is usually practicable for anybody to obtain permission to attend University or other courses for the purpose of instruction merely, and not with the intention of afterwards proceeding to a degree or a diploma, but such a course is naturally of little value as a professional qualification, and is usually only followed by leisured enthusiasts.

The conditions of entry to the Agricultural Institutes at Berlin and Bonn-Poppelsdorf are rather less stringent, and at these institutions the students are only required to produce the same certificates as are demanded from those who claim to be allowed to serve only one year in the army. This means that they have obtained from a recognised Secondary School an easier leaving certificate than that described above, and that they have not necessarily spent any time in the top form of the school. Students, however, whose ultimate intention it is to become teachers of agricultural subjects in an Agricultural Secondary School are required to possess the full leaving certificate obtained after having spent the necessary period in the highest form of a Secondary School, and in addition to show that they have had at least three years' practical experience in agriculture. Those students whose ultimate intention it is to become teachers of practical subjects in Lower Agricultural Schools, or who desire to qualify for appointments as peripatetic teachers, need only produce the easier leaving certifi-

cate, but in their case it is necessary to produce evidence of at least four years' practical agricultural experience. Those who enter the Institute at Bonn-Poppelsdorf become matriculated students of Bonn University.

Before giving a description of types of the various University and other Agricultural Institutes it will be of interest to outline the history of the development of this branch of higher education.

As far back as the year 1700 Thomasius was teaching agriculture in the University of Halle; in 1727 King Friedrich Wilhelm I. founded certain Professorships at Halle and at Frankfurt-on-the-Oder, and part of the duties of the professors appointed was to give instruction in the principles of agriculture. These examples were quickly followed, and most German Universities soon taught some form of agriculture as a subject which might be taken by students who were interested in the land, either because they intended to become farmers after their student days or because they hoped to obtain positions in the Government service. It was for these latter that the facilities for an education in agricultural subjects chiefly existed during the course of the eighteenth century, but it was not until the beginning of the nineteenth century that the farming community began to be benefited by the possibilities of obtaining a practical education in agriculture. At the beginning of that century it was recognised that the foundation of special institutions was a necessity, and in the year 1807 Thaer founded his Institute at Mooglin, near Freienwalde-on-the-Oder. Although this Institute received State assistance and recognition, it remained essentially under private administration. This Institution was the precursor of many others.

It was in 1835 that the first purely State Institution was founded at Eldena in connection with the University of Greifswald. In May, 1847, the second State Institution was founded at Poppelsdorf, in connection with the University of Bonn. Among others that followed was that at Berlin, which was founded in 1859 by Professor Schulz-Fleeth with funds provided by the State. This was reorganised in 1862. At first the students were matriculated at the University of Berlin, but in 1866 the Institute obtained the right to matriculate its own students.

In 1861 a movement was started to incorporate all those Agricultural Institutions that stood alone with one or other of the Universities. The idea upon which this movement was founded was, to a large extent, the self-evident fact that the presence of a University acts as a spur on scientific research, and further, that a University has at its disposal a large number of teachers and professors who must be of great use to such an Institution. In addition, a University is usually possessed of more funds than a specialised Institution, however wealthy. The result of this movement was that some Universities that possessed no Agricultural Institutions founded such Institutions, and others that already had them aimed at extensions; and certain Institutions that stood alone and, by reason of their geographical situation, could not find Universities with which to be incorporated, disappeared at this time.

As usual, however, with movements of this type, an opposition school arose, and argued that as the Technical Colleges (*Technische Hochschulen*) are found to work well when they exist apart from Universities, so the Agricultural Institutions are best when working apart from the Universities, always assuming that they are adequately equipped and financed. This policy was carried into effect when the Agricultural Institution at Berlin was made an Agricultural College (*Landwirtschaftliche Hochschule*) in the year 1881, and thereby became an Institute of University rank. This policy led in recent years to the foundation of the Kaiser Wilhelm Institute at Bromberg in 1906, though it is hardly probable that it will attain to the rank of an Institution equivalent to a University. Thus at the present time there are three Agricultural Colleges which for administrative purposes stand alone and represent the new policy of the Government:—the Agricultural College at Berlin, the Kaiser Wilhelm Agricultural Institute at Bromberg and the Agricultural College at Bonn-Poppelsdorf. The last-named, however, is still loosely connected with the University of Bonn. Then, as representative of the old policy, there are Agricultural Institutes connected with the Universities of Königsberg, Breslau, Halle, Kiel and Göttingen.

The following table gives the names of the various higher

agricultural institutions with the date of their inauguration under their present status, together with the number of students in the year 1908, and the total number of students since the date of opening:—

Name of Agricultural College, or University with an Agricultural Institute.	Year of Opening	Number of Students of all Kinds in 1908.	Total Number of Students since Opening to the Year 1908–9
Berlin	1881 *	845 †	26,566
Bromberg	1906	3	17
Bonn-Poppelsdorf	1847	509 ‡	6,121
Konigsberg	1876	50	1,710
Breslau	1881	84	2,547
Halle	1863	319	20,884
Kiel	1873	1	160
Gottingen	1872	90	2,459

* This was the year in which it was given the title of Agricultural College.
† In the Winter Half-year of 1911–12 this number was 805.
‡ " " " " " 520.

The following table gives some account of the financial position in 1911 of the three independent Agricultural Colleges:—

Name	Receipts from own Resources.	Ordinary Current Expenditure.	Special Expenditure on Buildings, etc.	Total Expenditure.	Amount required from State.
	£	£	£	£	£
Berlin	8,794	30,130	5,001	35,131	26,337
Bonn-Poppelsdorf	4,882	15,694	—	15,694	10,813
Farm at Dikopshof	5,881	5,809	—	5,809	—
Bromberg	2,625	14,814	1,222	16,037	13,411

It is impossible to give similar figures for the five Institutes connected with the Universities, as the work of these Institutes is not sufficiently separate in its administration from that of the Universities. In the year 1907, however, the following was the amount of State aid received in each case, apart from the salaries of professors:—

	£
Konigsberg	1,948
Breslau	1,814
Halle	5,464
Kiel	168
Gottingen	1,689
Total	11,083

At the Agricultural College at Berlin there is a staff of about eighteen full professors, twenty-two lecturers and honorary professors, eleven recognised teachers (*Privatdozenten*), and thirty-five assistants of various kinds. The College is divided into three main divisions—the agricultural division, the geodetic division, and the division of fermentation and sugar manufacture. The chief courses of lectures are on (1) agriculture, forestry and horticulture; (2) pure sciences; (3) veterinary science; (4) law; (5) building construction, water-works, road and bridge construction; (6) geodesy and mathematics. All the necessary laboratories and workshops are available, and there is a library and museum, the latter not only containing botanical and zoological collections, but also a collection of agricultural machines and implements and models of agricultural buildings.

It is impossible to give the details of the various courses, but it will be seen from the large number of professors and lecturers that the College possesses experts in almost every branch of theoretical and practical agriculture and its allied sciences.

There is a small area of ground available for experimental purposes.

The usual fee for each half-year is £6 for Germans and £9 for foreigners, with an entrance fee of 10*s*. and 15*s*. in each case. There are also certain other small fees required from those who use the various laboratories.

In addition to the ordinary courses of the College there are special courses held for farmers and civil and military officials. There are also courses in meteorology and pisciculture.

At Bonn-Poppelsdorf there are about eleven professors, fifteen other University teachers, and twenty-five assistants. The fees are practically the same as at Berlin, and the various courses cover the whole field of practical agriculture. The College possesses an experimental farm at Dikopshof. This has an area of 310 acres, and is carried on as a model farm on commercial lines. Numerous experiments with crops and manures are made, and milk, feeding and other trials conducted. It will be observed from the figures given above that this farm is self-supporting.

The Agricultural Institute at Bromberg is still very young,

and it is impossible as yet to indicate what its ultimate destiny will be.

Of the Agricultural Institutes carried on in connection with the Universities of Königsberg, Breslau, Halle, Kiel and Göttingen, it will be seen from the table on page 765 that the Institute at Halle attracts the most students, and is consequently the most important. It may therefore be taken as an example of these Institutes. It forms a definite part of the University of Halle, and its students matriculate at the University. There are about ten professors attached to the Institute, and about an equal number of other University teachers lecture on subjects allied to agriculture.

Lectures are given on all the usual agricultural subjects. The fees are those usually payable at a Prussian University, and amount to 6*s*. for each lecture hour per week each half-year; that is to say that a student taking ten lectures per week would pay £3 each half-year. There are also certain other small entrance and laboratory fees. An experimental farm of 282 acres, on which the customary demonstrations and trials are made, is situated near the Institute. There is also an experimental water-meadow.

Higher Veterinary Education.

In Prussia there are two large veterinary teaching Institutions—the Veterinary Colleges at Berlin and Hanover. Both have the rank of *Tierärztliche Hochschule*, and are therefore of University standing. There are also Veterinary Institutions at a good number of Prussian Universities, but these Institutes cannot hold veterinary examinations, and usually exist in order to provide part of an agricultural course, and are not specialised veterinary schools. At the Kaiser Wilhelm Institute for Agriculture at Bromberg there is a veterinary department, which is, however, chiefly used for research purposes.

The Veterinary College at Berlin was founded in the year 1790, and served at the beginning as a training school for military smiths and veterinary experts for the royal studs. It gradually grew, and became more and more technical and scientific until the present day, when it serves the purpose of a Veterinary University.

The Veterinary College at Hanover has had a similar uneventful history. It was founded in 1778 with a staff composed of one teacher, and has gradually grown to its present eminence. These schools have been administered by various State departments, but in 1872 they passed under the control of the Ministry of Agriculture.

Before the year 1903, prospective students were required to produce the lower of the two leaving certificates of which mention has already been made. Since that date, however, the full certificate necessary for admittance to a University has been demanded; this has had considerable influence on the number of students at both Institutions, which since 1903 has shown a marked tendency to decrease.

Before a veterinary student can sit for the final veterinary examination, he must have attended the Veterinary College for at least seven academic half-years. There are two examinations, the first of which may be taken after three academic half-years of study, and includes an oral examination in the following subjects:—anatomy of domestic animals (including histology), physiology, botany, chemistry, physics and zoology. The final examination can only be taken at the end of the seven academic half-years of study, and demands a thorough acquaintance with veterinary science and practice.

The scientific training of the students of the Military Veterinary School is provided by the Veterinary College at Berlin, which therefore possesses a large number of military pupils.

The Veterinary College at Berlin also examines students who wish to become inspectors of animal breeding. Before they can enter for this examination, they must have already passed the final Veterinary Examination above-mentioned. At this examination not only are veterinary subjects taken, but also some that are purely agricultural.

At the College in Berlin the following laboratories and departments are in use:—(1) anatomical and histological; (2) pathological-anatomical; (3) physiological; (4) chemical; (5) pharmaceutical; (6) hygienic, divided into two separate departments—(*a*) tropical hygiene, and (*b*) food hygiene; (7) medical clinic; (8) surgical clinic for large domestic animals; (9) general clinic for small domestic animals; (10)

general clinic for large domestic animals; (11) ambulatory clinic.

There are about twelve professors, sixteen lecturers, twelve assistant lecturers, and a large number of administrative and minor officials.

The fees paid by non-military students for each academic half-year average about £5 *7s. 6d.* The entrance fee is 6*s.* for Germans and £1 for foreigners. There are also small fees for post-graduate work. An English or other foreign veterinary surgeon can usually spend a short time (up to three weeks) in inspecting the methods followed in the laboratories and clinics without paying any fee, except the entrance fee of £1.

The conditions as to the number of laboratories, fees, &c., at Hanover are similar to those prevailing at Berlin.

The following table gives the number of students at both Veterinary Colleges, together with other statistics:—

Name.	No. of Students in Winter Half year, 1911–12	Total Cost of School.	Income	
			Own Resources.	Aid required from the State.
		£	£	£
Berlin	399	38,416	9,434	28,982
Hanover ...	287	15,182	6,673	8,509

Higher Education in Forestry.

The beginning of specialised education in forestry in Prussia goes back to the time of Frederick the Great, who started a Government Department of Forestry in 1770, but found that there was a lack of properly qualified forestry experts. In 1774, therefore, a course of forestry was started in Berlin with practical work carried on in the woods that surrounded that town, especially at Tegel. In 1802, however, this scheme collapsed. In 1821 a School of Forestry was opened at Berlin in connection with the University, but again the attempt did not succeed as well as was hoped, and it was

decided to move the School to a town surrounded by forests. This was done, and in 1830 the School of Forestry recommenced in Neustadt-Eberswalde. In 1868 a second School of Forestry was opened at Münden.

Students who wish to be admitted to these Schools of Forestry have to produce the higher of the two leaving certificates that have already been mentioned, and in addition they must show that they have a thoroughly satisfactory knowledge of mathematics. A seven months' period of practical training is also demanded before they are admitted to the School. In the case of foreigners and those who do not intend to enter the German State Service these regulations are not strictly enforced, if such candidates for admission can give proof of having received a good education.

The purpose of these two schools of forestry is to give a complete scientific training in the principles of forestry, and in the subjects to which the main subject is related, with the idea of producing efficient forestry experts for the State Service.

Those students who intend to enter the State Service are required to spend six academic half-years at the School of Forestry, and then, later, two academic half-years at a University.

The following table gives some statistics of the two Schools :

Name	No of Students in Winter Half-year, 1911–12	Total Cost of School	Income	
			Own Resources.	Aid required from the State.
		£		£
Eberswalde	70	10,238	538	9,700
Munden ..	74	5,472	671	4,801

At Eberswalde there are about twelve professors, several lecturers, and a number of assistants of various kinds. The fees are about £7 10*s.* yearly for Germans and £15 for foreigners, with entrance fees of 15*s.* and £1 10*s.* respectively.

Similar conditions as to fees, &c., hold good at Münden.

Higher Horticultural Centres.

Prussia possesses three centres for higher horticultural education. The Royal School for Gardeners at Dahlem (*Die Königliche Gärtnerlehranstalt*), which was founded in 1823; the Royal Pomological Institute at Proskau (*Das Königliche pomologische Institut*), opened in 1868; and the Royal School for Fruit Cultivation, Vine-growing and Gardening at Geisenheim-on-the-Rhine (*Die Königliche Lehranstalt für Obst- Wein- und Gartenbau*).

These Institutions differ in several general aspects from the Institutions which have already been mentioned, and not one of them makes any claim to be of University rank. The one that stands highest in this respect is Dahlem, which demands of its students that they should have attained to the lower only of the two leaving certificates *or* have had a correspondingly good education, together with four years' practical experience in gardening.

At Proskau and Geisenheim the demands as to previous education are less, but both require that prospective students should have had at least two years' experience in practical gardening. In any case, however, a student who wishes to enter for the State technical examination in horticulture must possess the lower leaving certificate or its equivalent. The course usually lasts for two years, but at Geisenheim there is in addition a lower course lasting one year only, and open to practical gardeners of moderate education.

The Institutions already described fall into well-defined groups with similar powers, purposes and conditions, and differ only in their size, but each of the three Institutions now under discussion has its own special purpose and curriculum. Dahlem, though State-supported, is not, strictly speaking, a State Institution, and is managed by a Board of Governors. It has for its main purpose, in addition to teaching ordinary horticultural subjects, the training of efficient landscape gardeners for the State and other services. Proskau, which is a State Institute, has similar aims, but specialises in fruit-growing and the cultivation of useful garden produce. Geisenheim, also directly controlled by the State, offers courses in the same subjects as the other two, but, in addition, is well equipped for teaching the technicalities of vine cultivation

and studying the scientific and practical side of wine-making and maturing. The fees at the three Institutes differ considerably, and range from £12 10s. per year at Dahlem for Germans (£17 10s. for foreigners) to £4 or £5 at Geisenheim for each academic half-year. Girls and women are usually allowed to attend the courses.

The usual course is one of two years, the details of which differ at each of the Institutions; but in each case it is so arranged as to make full use of the practical knowledge that the students already possess. There are also shorter courses for special purposes, especially at Proskau and Geisenheim.

All three Institutions enforce a leaving examination on those students who have completed the full two years' course. Gardeners who have passed this examination may, after they have completed seven years' practical experience, of which three years must be after leaving the Institution, enter for an examination conducted under the auspices of the State, and, if successful, are granted a diploma, and the right to be termed master of their craft (*Staatlich diplomierter Gartenmeister*). The examination includes one or more of the following subjects, according to the candidate's choice:—

1. Landscape Gardening.
2. General Horticulture.
3. Fruit Cultivation.
4. Vine-growing.

The following table gives the number of students at each Institution for the year 1911–12, together with the income for the year:—

Name.	No. of Ordinary Students.			Others attending		Finance.		Aid required from State.
	Lower Course	Two Years' Course						
		Men.	Women	Men	Women	Cost.	Receipts	
						£	£	£
Dahlem ...	—	105	2	52	99	7,273	7,550	—*
Proskau	9	61	1	149	51	6,271	750	5,521
Geisenheim	30	104	—	227	49	12,614	4,340	8,274

* As this is not a State Institution the State-aid is included in the Receipts of the Institution. (In 1907 it received £3,820 from the State.)

It is desirable to mention that students at all the Institutes that have been described, which have University rank, carry on their work in the freedom that is traditional at German Universities, and that when once they have been matriculated they are practically free from examinations until they take their final degree examination, or enter for a State-conducted examination leading to a Civil Service appointment.

Finally, it will be observed that, considering the size of Prussia, the number of higher agricultural and other institutes is not great, and that in each of the four branches described above there is a tendency for most of the work to be concentrated at two or three Institutes. This is perhaps due partly to financial and other practical considerations, but also to a recognition of the danger of producing too many highly qualified experts, since, apart from the Service of the State, the openings for them are few.

FAULTY MILK: ITS DETECTION AND PREVALENCE.

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IN 1912 an investigation was conducted into the causes of certain defects in Cheddar cheese which were experienced in the autumn of that year on a dairy farm in Ayrshire. The results of this investigation, given below, should prove of interest and value to many dairy farmers in this country.

The trouble in question occurred on the farm of Boghead, in Ayrshire, a dairy farm of over 60 cows, well known for the high quality of its Cheddar cheese, and having an almost unequalled record for prizes for Cheddars at the London Dairy Show and other principal dairy shows throughout the country. In the autumn of 1912 the cheese from this farm, though apparently as fine as usual in every particular from the time of making until almost mature, developed a rather strong, unpleasant flavour just when ripening for market. Some of the cheeses were exhibited at the London Dairy Show as usual. A short time before the show the cheeses were very fine, but, when examined by the judges in London, they were distinctly defective in flavour.

The cow houses and dairy premises on this farm are quite suitable for the purpose, and every care is taken in the handling of the milk throughout, from the cleaning of the cows before milking until the cheese is made and transferred to the ripening room. The defects suggested that, in spite of all precautions, some contamination of the milk by putrefactive or pathogenic germs had taken place. These germs were inhibited, in a great measure, in the early stages of manufacture by the development of the ordinary milk-souring bacteria, but later, during the slower changes in the curing room, they made their presence felt injuriously, as described. The most likely source of trouble that occurred to the writer in the circumstances was the udders of the cows.

(1) In order to determine the source of the trouble, separate samples were first taken of the mixed milk of each lot of ten cows, each lot of cows represented in one sample being milked by the same milker. The six samples of milk were subjected to a simple bacteriological test known as "The Milk Fermentation Test." A number of ordinary bacteriological test tubes were plugged with cotton wool and sterilised by heating in a hot-air oven to 340° F. for 20 minutes; and 25 c.c. of each sample were poured into one of these sterile tubes and the tubes placed in the incubator at 98° F. The samples were examined at the end of twelve hours, and again at the end of twenty-four hours' incubation. This preliminary test was intended to show whether the source of the trouble was confined to one section of the cows or was more or less general over the whole herd.

The results from this fermentation test should be interpreted as follows:—Good, pure milk becomes firmly coagulated and shows a close, firm, uniform curd, without gas bubbles, or evidence of separation into curd and watery serum, and develops a pleasing acid flavour and aroma. Milk contaminated with dung particles shows a gaseous condition, and produces unpleasant odours, with more or less dissolving of the curd into watery serum. Milk contaminated with inflammatory germs from the udder, or other liquefying germs, either fails to coagulate at all or forms a curd which gradually dissolves into a watery serum.

In the test actually conducted the curd was found to be

badly liquefied in all the six samples. This result indicated that the cause of the trouble was present in the mixed milk of each lot of cows.

(2) A separate sample of milk was next taken from every cow in the herd, and each sample was subjected to the same test as before. The results after twenty-four hours' incubation were very striking. While the greater number of the tubes showed fine, firm, uniform curds without fault (classed as very good), a number showed gasiness with partial dissolving of the curd (doubtful samples), and a certain number were badly liquefied, with most of the curd dissolved into watery serum (bad samples). In some cases the milk had not coagulated at all, and these invariably turned out bad later. The milk samples were taken under as nearly as possible similar conditions, and were treated throughout the test exactly alike, but the differences at the end of the test were most marked. Sixty-six per cent. of the samples were very good, 18 per cent. were doubtful, and 16 per cent. were bad. The tests were repeated in the case of the cows from which the most affected samples were obtained, and the results from the second samples entirely confirmed those of the former tests. The agreement between the two results was considered as conclusive.

The bad samples showed all the symptoms of being strongly contaminated with inflammatory germs from "weeded" udders. Pure cultures of the inflammatory germs, inoculated into tubes of sterile milk, produced much the same effect upon the milk in the tubes as were visible in the worst of the samples described above.

It is noteworthy that the worst samples were from cows arranged almost exactly in three groups, as they stood in the cow-houses, five or six cows in each group.

The results of the investigation seemed so suitable for an object lesson that they were exhibited as part of the bacteriological section at the stand of the West of Scotland Agricultural College at the Highland and Agricultural Society's Show in the Glasgow district during the past summer. The exhibit attracted considerable attention.

It is clear that milk which cannot be fermented naturally in the manner indicated without developing objectionable

features should not be mixed with other milk for cheese-making; and it appeared certain that a considerable number of cows in the Boghead herd were giving milk that was distinctly injurious to the quality of the cheese. The problem was how to dispose profitably of the affected milk without contaminating the good milk. To discard all the unsound milk was held to be out of the question, while to handle all this milk separately and make butter of it was impossible in the circumstances without considerable pecuniary loss. It seemed that the requirements of the case would be met if the bad milk could be collected separately and adequately scalded before being mixed with the rest of the milk for cheese-making.

A temperature of 160° F., maintained for a few minutes, kills all germs likely to be found in milk. Unfortunately, this treatment cannot be extended to the whole of the milk for cheese-making, as it has the effect of partially destroying the coagulative properties of the milk when rennet is added, and causes the curd to be non-cohesive and granular or loose in texture, and to be too retentive of moisture. In fact, pasteurised milk cannot readily be made into good cheese by the ordinary methods, though experiments on this subject are at present being conducted with some success.* *The objections referred to, however, do not apply where only part of the milk is scalded.* Many of our older cheese-makers may remember that the usual method of heating the milk or whey in the vat many years ago was to remove a portion of the contents and heat it to scalding temperature in a heater and return it to the vat. Our suggestion seemed like a revival of an old custom, but it was put into practice.

The milk of the thirteen worst cows (21 per cent. of the herd) was kept apart from the other milk and scalded in a heater, evening and morning. This milk was heated to 160° F. The method of heating was simply to stand the vessel containing the milk in a tub of water and introduce steam from a steam pipe into the water in the tub. To avoid overheating the whole of the milk in the vat, the scalding of the evening's and morning's milk was carried out separately. In the

* See the article "Manufacture of Cheese from Heated Milk," *Journal*, July, 1913, p. 281.

evening the scalded milk was set in shallow pans on stone shelves in the milk room to cool, and kept thus till morning. The morning's scalded milk was added immediately to the milk in the vat and had the effect of heating up the whole of the milk to near the renneting temperature.

The only effects of this treatment apparent during the making of the cheese were that slightly more of the lactic starter was necessary to ripen the milk, the milk seemed to coagulate fully as readily with the same quantity of rennet as formerly, and the curd seemed more ready to cook or firm. These effects were no doubt due to the destruction by scalding of many of the liquefying germs, which were naturally antagonistic to coagulation and the production of a firm curd.

The cheeses, when matured, were examined by two well-known experts. A decided improvement in the quality of the cheese was noticeable from the very first day the scalding was introduced. The flavour particularly was distinctly purer and finer. It so happened that six cheeses (two lots of three each) were to be selected for exhibition at the Royal Agricultural Society's Show at Bristol, and five of the six cheeses selected were, unknown to the selectors, taken from among those made from the scalded milk; the other one was from the previous lot, and though it was pronounced at the time to be slightly inferior, it was required to make up the necessary number. The prizes gained by the two exhibits were a first and a second. Though the gentlemen judging were unaware that there was any difference in the making of the six cheeses they were of opinion that the flavour of five of the six cheeses was outstanding, but that the flavour of the other cheese was somewhat defective.

Several other herds of cows were subsequently tested in like manner, and in every case there was a larger percentage of bad samples than with the Boghead herd. The results of this short investigation suggest a simple, effective, and most practical remedy for this form of trouble in the handling of milk, whether for the milk trade, butter-making, or cheese-making. The little extra trouble and expense in having milk sampled and the samples tested as above, and in reserving the bad milk for scalding, is amply repaid.

Experience in the bacteriological laboratory of the West of

Scotland College has led to the opinion that the number of cows secreting unsound milk is great. This condition might be due to the after-effects of "weed" or inflammation of the udder. The cows which gave the bad samples of milk in the investigations at the West of Scotland College were mostly known to have suffered at one time or other from udder affections of this nature; a number of them, on closer examination, were observed to have one or more quarters slightly enlarged, and several had what is known as "a pea in the teat."

The milk of all dairy herds should be tested in some simple and inexpensive way similar to that described above, and the unsound milk should be adequately pasteurised before being marketed, whether disposed of in the form of milk, butter, or cheese. Cows with diseased udders should be isolated, and care taken that milk from a bad udder is not conveyed to a sound udder by the hands of the milker or in any other manner. Such cows should always be milked by a different person, and before milking each cow the milker should wash his hands in water rendered antiseptic.

EGG PRODUCTION FOR PROFIT.

J. C. NEWSHAM.

Hampshire Farm School, Basing.

The following description of an English egg farm in Hampshire, and the account of the methods that have been adopted by the proprietor to make egg production in this country successful, will be of interest to all who keep poultry for profit. The circumstances under which the farm was established are as follows:—The proprietor was perhaps one of the most successful of the large egg producers on Vancouver Island; two years ago he returned to England, purchased ten acres of farmed-out land, and commenced to build up a plant suitable for egg production on a large scale. The farm is run purely for profit, and is at present stocked with 1,600 White Leghorns. As regards housing, four large laying houses have been erected, each accommodating four hundred

birds, while a brooder house for 2,500 chickens, and various houses for cockerels and other stock are provided.

Hatching and Rearing.—Until recently half a dozen incubators were used on the farm, each capable of holding 360 eggs, but the proprietor has now installed an incubator of a new type, capable of carrying many thousands of eggs, and of effecting a saving in fuel and labour.

Eggs are set for hatching from April 7th to May 1st, so that the pullets may commence laying in October. On the average, six per cent. of the eggs prove infertile, while the number of fertile eggs hatched usually reaches 75 per cent. One half of the flock is reserved for breeding purposes, and for the remaining half pullets are substituted every year. In order to accomplish this, it has been necessary, up to the present, to incubate 4,000 eggs in two hatches. Eight hundred pullets are reared annually for renewing the stock on the farm. Some 20,000 eggs are sold for hatching each year, and the price obtained is 5*s.* for each sitting of 15 eggs, 35*s.* for a batch of 110, and £15 for 1,100. The extra number of eggs is given in order to cover inevitable breakages and infertile eggs. A sitting of eggs from a first-class laying pen of birds will, of course, be an expensive item. The proprietor of the farm in question states that he has paid as much as £5 for 100 such eggs.

Brooders or Foster Mothers.—The ordinary hot-water type of brooder is held in no great favour on this Hampshire egg farm. The ventilation is said to be faulty, and requires continual adjustment to keep in proper order; there are numerous lamps which require attention; the cost of working the brooder is described as being excessive, and the initial cost is high, while a great deal of valuable time has to be devoted to the regulation of the temperature. On the farm in question the temperature in the brooder house is greater near the pipes than elsewhere, so that the chicks, if cold, go near them, and if too hot away from them. This house is very large, and provides plenty of air space. Anthracite coal is used as fuel, and in order to attend to the fire properly, two visits in twenty-four hours are required. The proprietor estimates the actual cost of fuel at ½*d.* per chick for two months.

The special type of brooder used on this farm has a

capacity reckoned at 2,500 chicks. The brooder house is 110 feet long, 12 feet wide, and is divided into twenty pens, each 5 feet wide, and 8 feet long. There is a furnace pit in the centre, 10 feet by 8 feet, and a passage at the back, 4 feet wide, running the entire length of the building, with doors at each end, and one door at the back opposite the furnace, with removable windows in the doors. The floors are of boards, which are covered with sand and small litter to a depth of 3 inches. On the north side are six windows, and the south side is of glass. Wire netting is used for the divisions and gates into the passage. In each of the twenty separate pens in the brooder house 125 chicks are accommodated, the number being gradually reduced by, say, twenty-five per cent. of deaths, and by the removal of a certain number of cockerels as soon as the sex can be distinguished, thus reducing the number of birds in each department as they grow in size. The birds actually remain in the brooder house for from six weeks to two months, according to the weather conditions; but in the case of White Leghorns, practically all the cockerels can be detected at two months, and quite a large number at from five to six weeks.

Housing Accommodation.—The farm itself is situated at an elevation of six hundred feet. The housing accommodation for the birds is a matter of difficulty, especially in the case of a commercial egg farm where large flocks have to be catered for. On the farm under consideration, the pullets are removed to small portable colony houses when the laying-houses are full of adult stock; and they remain there until they are about five months old. Each of the temporary colony houses is large enough to accommodate 50 birds. The floor is of loose boards, covered with earth and straw; the front is of wire, and there are three perches. These colony houses are 6 feet wide, 4 feet high in front, and 3 feet high at the back. They are built of timber, and covered with a patent roofing felt, and are portable. In short, they may be described as miniature laying-houses.

The permanent quarters for the adult fowls are much larger, each house being built to accommodate four hundred birds; they are 9 feet wide, 180 feet in length, 7 feet high in

front, 4 feet high at the back, and are divided into a number of partitions at every 10 feet by a board running 6 feet across the floor. The houses are also fitted with glass fronts, and there is a wire covering under the hood to allow free circulation of air. There are perches at the back, fixed over a dropping board 2 feet wide and raised to a similar distance above the ground; the boards are covered with fresh earth every week.

In the front are placed removable nest boxes, and over these and under the hood are situated broody coops. At the north and south sides of the house are doors for hens, and the attendants can enter by means of doors placed at the two ends of the house, and also at intervals of 30 or 40 feet along one side. Each house stands on one acre of ground, and the birds run on to the south half-acre in winter, and on to the north half-acre in summer; and as soon as the plot of ground is vacated by the birds, it is immediately ploughed and sown with wheat and thousand-headed kale. This system of management ensures an adequate supply of fresh green food for the birds, and at the same time keeps the soil sweet and wholesome.

Feeding.—The thousand-headed kale that is grown as described in the preceding paragraph is supplemented by an extra half-acre or so of the same fodder crop, which is grown every year, and, if necessary, a few tons of roots, such as turnips, swedes, or mangolds, are purchased and scattered whole—not cut up—on the ground so that the birds can peck all the flesh out of them. The latter course is, however, only adopted when the green food is short in the yards. Fish or meat in a suitable form is always provided, to the extent of at least 10 per cent. by weight, in the dry mash, as a substitute for grubs, worms, and similar natural food. Ground raw bones are also sometimes fed, but not regularly, for the supply of these is intermittent, and an engine would be required to grind them at home, which would involve a further outlay of capital.

The following statement indicates the general system of feeding as practised on this egg farm, (*a*) from the time of hatching until egg-laying commences, and (*b*) during egg production :—

(*a*) Chick food is given for one week, then chick food and dry mash. At three weeks a little wheat is introduced into the ration, and at five weeks all the birds are on wheat. The chicks have food before them continuously.

(*b*) During the period of egg production the birds are fed on a ration consisting of two-thirds of wheat and one-third of cracked maize. This is fed in 6 inches of litter in the morning, and dry mash food is always at hand for the birds. The latter are also provided with as much green food as they will eat, especially in the winter, as well as grit, shell, and charcoal.

The cost of feeding during the period from the time of hatching until egg-laying commences is roughly estimated at 2*s*. per bird; in the second case the cost of feeding during egg-production is a variable quantity to a certain extent, according to market fluctuations, but it is reckoned that from 6*s*. 3*d*. to 6*s*. 6*d*. per bird per annum is a fairly representative cost.

A good supply of clean, pure water is available, and in the present instance the proprietor is fortunate in having a continuous supply from the borough main, and if that fails he has at least 1,000 gallons always in reserve for his birds. Pipes are laid on to each house from the main, and short lengths of piping are also fixed under each house, with taps easily available at both sides. The taps are underground, and there is a length of piping screwed on and projecting above ground; the latter can be easily unscrewed, and, as the water runs out of the tap, which is below ground, it does not freeze. A little permanganate of potash is put into every drinking-dish that is placed before the birds.

Precautions Against Disease.—One of the outstanding features to be noticed on this farm is the entire absence of disease in the poultry pens. The birds are all bred from perfectly healthy stock, and the houses and yards are kept in a scrupulously clean and thoroughly sanitary condition. No outside stock are purchased, and all weakly and puny birds are killed at once, so that there shall not be the slightest risk of disease. In order to aid in the maintenance

of cleanliness and sanitation, the perches are creosoted monthly, the laying-houses are disinfected at similar intervals with a spray pump, and the floors and dropping-boards are tarred annually.

Labour and Marketing.—The following particulars furnished by the proprietor are connected with the economic side of commercial egg-production, and the cost of labour and marketing of the produce. The amount of attention required by a flock of 400 birds is reckoned as follows:—

	Hours per week.	Hours per year
Watering twice daily (30 minutes)	3½	182
Grain fed once daily (30 minutes)	3½	182
Dry feed twice weekly	4	208
Cleaning house once weekly	1	52
Spraying once monthly	—	12
Creosoting perches	—	12
Annual clean	—	72
Providing grit and shell	—	12
Collecting eggs (15 minutes daily)	1¾	100
Total number of hours for one man per year		832

As only one breed is kept on this farm, and the system of dry mash feeding is practised, two men are able to look after four houses and 1,600 hens, water and feed the latter, collect, pack and despatch the eggs, attend to a pony, do all the gardening, and clean a motor.

As regards the cost of marketing the eggs, the railway charges from the nearest station to London, a journey of 47 miles, amount to 1*s.* 8*d.* per 30 dozen eggs, or a little less if 120 dozen eggs are sent to one address. Particular care is taken to sell only infertile eggs, and not a single egg is purchased from another farm. The old hens are disposed of as follows: the best are kept for breeding, either for the home farm or for sale for the same purpose, and the others are sent to London and sold at Smithfield. Some are sold at twenty months, and others at thirty months, after their breeding season. The average prices realised may vary from 2*s.* to 2*s.* 6*d.* When sold for breeding, they are usually expected to realise from 5*s.* to 7*s.* 6*d.* each.

The Market for Eggs.—The business is entirely a wholesale one, and the proprietor has been very successful in establishing a first-class connection with big London dealers.

Further, he is able to secure good wholesale prices for them, as the following record shows:—

March, April, and May ...	1s.	per dozen.
June, July, August, and September ...	1s. 3d	,,
October, November, December, January ..	1s. 9d.	,,
February ...	1s. 5d.	,,

Complete records are kept of the number of eggs produced at all times of the year, and the totals for the best winter months were as follows:—

January ...	7,616 eggs.
February ...	7,310 ,,
March ...	8,606 ,,
Total ...	23 532

The figures given above represent the total number of eggs produced by a flock of 402 pullets during a period of 90 days. Two hundred of the birds had been hatched in June, and some as late as June 26th. A poultry farmer expects about a gross of eggs per bird, but often the average of the ordinary farm flock falls as low as 70. The records kept on the farm under discussion showed that flocks of 900 birds had been kept, averaging 176, 168, and 162 eggs per bird. On the average, each egg weighs 2 ounces or a little over.

SUGAR BEET PULP FOR FEEDING LIVE STOCK.

THE most important of the bye-products of the sugar beet is the pulp, which is the residue left after the sugar has been extracted from the beets. In some cases on the Continent and in the United States it is customary for the farmer, in contracting to grow beets for the factory, to stipulate that he shall receive a certain amount of pulp free of charge or at less than the market price.

Composition of Pulp.—The composition of the pulp varies according to the process of sugar extraction used in the

factory. The method chiefly employed is known as the diffusion process, in which the beets are cut into slices, and the juice dissolved out by the action of hot water. On the average, in the diffusion process, 100 lb. roots containing 15 per cent. of sugar produce (when topped, washed and sliced) 45 lb. fresh pulp with about 93 per cent. water, or 30–35 lb. pressed pulp with 85–90 per cent. water, or 5–6 lb. dried sugar beet slices with 10 per cent. water.

In a pamphlet issued by the German Agricultural Society,* the following is given as the composition of various kinds of pulp :—

	Fresh Diffusion Pulp.	Pressed Diffusion Pulp	Ensilage from Diffusion Pulp.	Dried Diffusion Slices.	Dried Molasses Slices	Dried Steffen Slices.
	%	%	%	%	%	%
Water	93 0	85 0	88 4	11 2	10 0	8 6
Crude Protein ...	0 6	1 3	1 0	8 1	8 7	7 1
Digestible Albuminoids	0 3	0 6	0 3	3 6	2 7	3 5
Crude Fat	—	0 1	0 2	0 6	0 3	0 4
N.-free extract substances	4 7	9·9	7 2	58 5	60 8	67 9
Sugar .	0 3	0 4	—	4—5	16—20	30—35
Crude Fibre	1 4	3 0	2 3	17 6	13 8	11 8
Ash	0 3	0 7	0 9	4 0	6 4	4 2
Starch Equivalent	5 0	10 6	6 5	51 9	50 5	58 9

The following composition of various kinds of pulp is given in the Report on the Progress of the Beet Sugar Industry (U.S.A.) for 1902 :—

	Fresh Pulp	Pressed Pulp	Dried Pulp.
	Per cent.	Per cent	Per cent.
Water	94 0	89 8	5·0
Crude Protein	0·5	0 9	8·39
Crude Fibre	1 4	2·4	22 35
Non-nitrogenous Matter	3·6	6 1	56 81
Crude Fat	0·1	0 2	1·86
Ash	0 4	0 6	5 59
Digestible—			
Albuminoids . ..	0 3	0 6	—
Non-nitrogenous Extract Matter . .	3 0	5 1	—
Crude Fibre	1·2	2 0	—
Fat	0 1	0·2	—
Nutritive ratio...	7·65	7 28	7·25

* Flugschriften der Deut. Landw Gesell. Heft 10. Melasse, Futterkalk und Salz., 1911.

A process (the "Steffen" process) has been installed in some factories in Germany, which gives the pulp a high feeding value by leaving a larger percentage of sugar in the pulp. According to Kellner* the fresh Steffen pulp contains 30 to 35 per cent. of dry matter, and 10 to 12 per cent. of sugar, and when dried it has the following composition:—Water, 8·6 per cent.; crude protein, 7·1 per cent.; fat, 0·4 per cent.; carbohydrates, 67·9 per cent.; crude fibre, 11·8 per cent., and ash 4·2 per cent.

Beet pulp has a high digestibility. Honcamp† carried out digestibility experiments on sheep, and obtained the following digestibility coefficients:—Dry matter, 86 per cent.; organic substances, 88 per cent.; crude protein, 60 per cent.; carbohydrates, 94·5 per cent., and crude fibre, 76 per cent. On this basis, air-dried slices with 8·6 per cent. of water have the following digestible nutrients:—Crude protein, 4·3 per cent.; carbohydrates, 63·8 per cent.; crude fibre, 9·0 per cent.; albuminoids, 3·5 per cent. From this it appears that slices are among the most digestible agricultural bye-products. The starch equivalent is 58·9.*

Pulp Ensilage.—The chief disadvantage connected with the use of fresh pulp is that it has to be carted away from the factory at a time when labour is badly needed for other work on the farm. The factory season lasts in mid-Europe for about ten to eleven weeks, so that if the pulp is to be given to stock all the year round, about four-fifths of the total amount has to be preserved, as fresh undried pulp soon deteriorates when exposed to the air. Beet pulp is preserved in silos both in America and on the Continent. A common form of silo in the United States is a large slanting trench dug in the ground, the walls being made of wood, brick, or cement, and the top covered with hay, straw or boards. A system of drainage is considered desirable.‡

Wolff § states that the fermentation of the pulp in a silo

* *Arb. der Deut. Landw Gesell.*, Heft 152.
† *Landw. Versuchsstat.*, 1907, p. 381.
‡ *Progress of the Beet Sugar Industry, (U.S.A.)*, 1903.
§ *Farm Foods*, Wolff.

always results in loss of dry matter and reduced digestibility. The loss is estimated as follows:—

	Dry Matter.	Crude Fibre	Crude Albuminoids.	N.-free Extract
	Per cent	Per cent	Per cent.	Per cent.
Minimum	14·0	9 0	5 0	15·0
Maximum ...	46 0	52 0	40·0	57 0
Average .	34 8	19 6	24 5	37 8

It is very important in ensiling that the fermenting mass should be well trodden down to a compact and air-tight consistency. Mixing the pulp with absorbent materials to prevent loss has not given good results. Wolff found that the addition of chaff increased the loss of organic matter from 21·8 to 29 per cent. According to Malpeaux, pulp ensilage loses about 35 or 40 per cent. of its weight in five months.

Further disadvantages of wet pulp and pulp silage are* (1) that the composition varies considerably according to the method of preservation adopted; (2) that the pulp takes up much room, and harbours disease germs; (3) that the feeding of pulp silage in winter occupies much time, and is very unpleasant work; and (4) that the milk of cows fed on considerable quantities may take on a "pulpy" flavour.

Dried Pulp.—Many factories in Germany have apparatus for drying the pulp into flakes, this dry pulp containing as much dry matter as eight times its bulk of wet pulp. The advantages claimed for dry pulp are (1) the ease with which it can be transported; (2) the destruction of disease germs by drying; (3) the ease of preservation without deterioration; and (4) the freedom from objectionable flavour in the milk of animals fed on it. In feeding it to cattle it is usual to soak it in water for twenty-four hours.*

In the manufacture of dried pulp, molasses are often mixed with the pulp. (See composition of dried molasses slices, p. 785.) Both in France and Germany a commercial feeding stuff has been made from dried sugar beet slices which has

* *Rubenbau*, Knauer-Hollrung

the following composition:—Water, 10–12 per cent.; crude protein, 6–7 per cent. (albuminoids, 3–4 per cent.); crude fat, 0·1 to 0·4 per cent.; nitrogen-free extract substances (including sugar, 54–64 per cent.), 60–74 per cent.; fibre, 4–7 per cent.; and ash, 4–14 per cent. According to French writers (Muntz, Girard, and Malpeaux) 26 lb. per head per day of mangolds for milch cows can be replaced by 4½ lb. per head per day of dried slices, with good results.*

Feeding Value of Pulp for Live Stock in General.—According to Shaw † the physiological value of the pulp, due to its exercising a salutary effect on digestion, decreases with increase in the quantity fed, and may be lost entirely by excessive feeding. When fed in large quantities it induces a lax condition of the bowels, and it is advisable to give dry foods with it. Wheat, bran, clover, and lucerne make very suitable complementary foods.

The following advice as to feeding pulp to animals is given in the Report on the Progress of the Sugar Beet Industry in the United States for 1902:—"Owing to the laxative tendency of the pulp, the digestive apparatus of the animal must be allowed to adjust itself to the new food. A full supply of pulp should not be furnished immediately; the best practice in all cases of fattening is to begin on a small amount of pulp, say 40 lb. per day for a steer, and gradually work up to 80 lb. per day, then down again to 40 lb., giving the animal a chance to 'finish' or to harden in flesh. Milch cows may be gradually worked up from 20 lb. to 40 or 50 lb. per day, and the amount kept regularly in their diet. Fattening lambs or sheep are put on from 1 to 2 lb., and gradually worked up to 7 or 8 lb., gradually diminishing to the minimum with the 'finish.' In feeding pulp, a liberal supply of salt should be used, as the results are always shown to be beneficial."

Dried slices have a sweet malt-like taste, sharpen the animals' appetite, their dietetic properties have a very favourable effect on the animal organism, and, as a rule, the animals soon learn to eat them very readily.

Results of some English Experiments with Slices, mostly

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* *Mitt. der Deut. Landw. Gesell.*, 1906, *Stuck* 28 *Beilage.*

† *Feeding Farm Animals*, Shaw.

of German origin, for Fattening and Dairy Cattle.—Experiments were carried out in January, 1911, at the Royal Agricultural College at Cirencester to test the relative values of dried sugar beet slices and mangolds in a ration for dairy cows. A slightly higher milk yield (23 lb. more per cow per week), with a slightly lower fat content, was obtained from the dried slices. The butter from the cows fed on slices was harder and more difficult to work, but of better colour than that from the cows given mangolds. The dried slices at first seemed to have a laxative effect till the animals settled to their feed. The cows did not take readily to the dried slices, and seemed to lose their flesh and bloom more readily than the cows fed on mangolds. The composition of the mangolds and dried slices was as follows (mangolds are given first):—Water, 87·6, 15·1; nitrogenous matter, 1·2, 8·2; fibre, 1·0, 19·7; ash, 1·1, 2·7; and carbohydrates, 9·1, 54·3.

It was concluded from an experiment carried out early in 1912 at the Norfolk Agricultural Experiment Station that slices can be very well used in the place of roots for fattening cattle, and that 14 lb. of dried slices are equivalent for this purpose to 1 cwt. of ordinary mangolds, and rather better than 1 cwt. of swedes. Thus, according to this experiment, if good roots are worth 10*s*. per ton, dried slices should be worth £4 per ton. The slices contained: water, 9·5 per cent.; crude protein, 10·6 per cent.; carbohydrates, 61·8 per cent.; fibre, 15·3 per cent.; and ash, 2·8 per cent.

Experiments carried out by the Norfolk Station in the winter of 1912–13 with dried slices from the Cantley factory did not give such good results as those of the previous year. Twenty bullocks were fed on 6 lb. per head per day of a mixture of linseed and cotton cake for the first part of the winter, and were finished on 9 lb. of the same mixture. Half of the animals received roots rising finally to 1½ cwt. per head per day, and half received dried sugar slices rising to 21 lb. per head per day (this being the proportion indicated as their relative feeding values in 1911–12). The total gains in live weight per head per day were nearly 2 lb. in the case of roots and very little over 1½ lb. in the case of the slices. According to the 1912–13 experiments, therefore, more than

14 lb. of slices will have to be used to replace 1 cwt. of roots. The slices in 1912–13 contained:—Water, 10·48 per cent.; fibre, 10·40 per cent.; protein, 8·12 per cent.; ash, 3·56 per cent.; and soluble carbohydrates, 67·44 per cent. The analyses of the slices in the two years show clearly that they cannot take the place of cake or other concentrated food. They are only suitable as a substitute for roots, and for this purpose they appear from the 1912–13 experiments to be worth about £3 10*s*. per ton, if roots are worth 10*s*. per ton.

Experiments were carried out at Wye in the autumn of 1911 with two kinds of dried slices, *viz.*:—

	Ordinary Slices.	"Steffen" Slices.
	Per cent	Per cent.
Crude Protein ...	8 1	6 3
Crude Fat ...	0·5	0·5
Carbohydrates ...	64 4	68 6
Sugar ...	5 6	35·5
Crude Fibre ...	18·7	10 5
Ash ...	3 4	4 5
Moisture ...	6 9	9 6

The ordinary slices when soaked in water and mixed with chaff were found to form a sound and useful food for fattening cattle. With animals tied up in stalls it was not found advisable to give more than 7 lb. of slices per day, the animals eating 7 lb. of slices and 8 lb. of mangolds with chaff more readily than 8 lb. of slices without mangolds. One lb. of the ordinary dried slices used was found to be equivalent to 8 lb. of mangolds.

The "Steffen" slices when soaked in water and mixed with chaff, &c., formed an appetising food for milking cows, more appetising than chaff, &c., and mangolds; 8–10 lb. per head per day of the Steffen slices were given to cows of 9–11 cwt. without any notable laxative effect; 10 lb. per head per day had no effect on the percentage of butter-fat in the milk, or on the colour and flavour of the butter produced.

The experiments at Wye with ordinary slices show that, taking the ratio of the value of mangolds to dried slices as 1 : 8, it is not worth while to feed slices at £6 per ton unless

mangolds cost more than 15*s*. per ton to grow; or, on the other hand, taking mangolds as worth 10*s*. per ton, dried slices are not worth more than £4 per ton.

Mangolds were compared with dried slices at the Harper Adams Agricultural College in 1912. The slices had the following composition:—Oil, 1·21 per cent.; albuminoids, 10·50 per cent.; carbohydrates, 60·50 per cent.; fibre, 15·90 per cent.; ash, 3·60 per cent.; and moisture, 8·29 per cent. The mangolds used were Suttons' "Yellow Globe," containing 10·90 per cent. of dry matter and 6·80 per cent. of sugar. The mangolds were fed at the rate of 84 lb. per head per day, and the dried slices at the rate of 12 lb. per head per day, these slices being soaked in water for twenty-four hours before being fed, and absorbing about 45 lb. of water. In addition, cake and corn and straw chop were fed. The experiment was conducted with eight shorthorn bullocks during eight weeks, and the average gain per head per day for the period of the experiment was 1·88 lb. in the case of beet slices, and 1·74 lb. in the case of mangolds.

Results of German and American Experience in Feeding Pulp to the Various Classes of Stock.—The following information is given by various German and American authorities with regard to the feeding value of the pulp for different classes of stock:—

Kellner (*Feeding of Animals*) states that beet pulp either fresh or made into sour fodder, has given very good results with fattening bullocks and dairy stock; the quantities fed are 60–80 lb. per 1,000 lb. live weight for the former class of stock, and for the latter not more than half these amounts. There is a danger in feeding large amounts of this material to cows, unless concentrated food rich in protein and fat is given, that a hard white butter of bad flavour will result. Pregnant animals and young stock ought only to receive moderate quantities of the fresh pulp. Horses which are either not working, or only to a slight extent, may occasionally be given small quantities of the pulp.

Serious cases of illness have been noticed where animals have been fed with the beet pulp that has undergone decomposition, but dried slices very seldom cause any disturbance.

Fattening stock may be given 10–15 lb. of the latter; cows, 6–10 lb.; draught oxen, 10–14 lb.; calves, according to their age, 1–5 lb.; and pigs, 1½–4 lb. It is advisable to soak the beet slices either in hot water, dilute molasses, skim milk, or whey before giving them to pigs.

The dried sugar slices from the Steffen process may be fed in the following amounts to stock:—Cows, 6–8 lb.; bullocks, 10–12 lb.; draught oxen, 8–10 lb.; horses, 4–6 lb.; fattening pigs, 3–4 lb.; and young cattle, 1–2 lb. It is to be remembered that the material is poor in bone-forming mineral substances.

Coburn states that, given alone, sugar beet pulp is not of practical value for pigs, but it may be used advantageously with grain or concentrated food as a succulent supplementary food, to promote digestion, and increase the appetite.

The Colorado Station (Bull. 74) compared the feeding value of sugar beet pulp for swine with sugar beets, and in conjunction with wheat and barley. The hogs did not relish the pulp by itself, but in a few days they were eating greedily a pulp and grain mixture. The conclusions reached were as follows:—On account of its cheapness and effect on growth, pulp may be profitably fed to growing pigs in connection with a grain ration, or during the first part of a fattening period. The pulp gave a return of 1·50$ (6*s.* 3*d.*) per ton when fed in combination with grain, and served the same purpose in the rations at less expense. It was necessary at first to mix the pulp with the grain to induce the pigs to eat it. Feeding more than 2 lb. of pulp with 1 lb. of grain in a ration for pigs weighing from 100–200 lb. is not recommended.

Shaw states that 5 to 20 lb. per day may be given to young cattle according to their size and the amounts of other food fed. To cattle that are finished, as much as 75 lb. per day may be given. The pulp is particularly valuable for dairy cows; 50 lb. per day may be fed for long periods, and for shorter periods much more than that amount. In its dried form 3 to 5 lb. per day may be given to cattle.

In its undried form pulp is not so valuable for horses as for cattle or sheep, but a few pounds may be given daily with considerable benefit to young animals and brood mares on dry

feed. If fed in considerable quantities to horses at hard work, it is too laxative.

It is excellent for breeding or fattening sheep. A very fair quality of mutton may be made from pulp and clover or lucerne without grain, but under average conditions a limited amount of grain will tend to cheapen the ration. It will seldom be found profitable to give sheep more than 10 lb. daily, and a smaller quantity will usually be more profitable.

At the Michigan Experiment Station (Bull. 220) the feeding value of dried pulp for sheep was found to compare favourably with maize. Grain mixtures containing dried beet pulp produced mutton at a less cost than similar amounts of grain mixtures alone.

THE CULTIVATION OF CELERY.*

EDWIN BECKETT.

CELERY (*Apium graveolens*) occurs wild in marshy ground in England, and in Europe generally, but the taste and smell when found in its natural habitat are most disagreeable. It appears, however, that the higher the state of cultivation and the more thorough the blanching, the better is the flavour of this all-important crop. Celery is regarded as one of our most wholesome vegetables, and it is valuable in the kitchen garden for more reasons than one: apart from its being in great request both as a green salad and a cooked vegetable, no crop leaves the ground in better condition for the succeeding one. Celery responds to, and also pays for, good cultivation, and it is one of our vegetables that cannot be produced too large for table use, *i.e.*, consistent with good quality, as the larger the "sticks" the better is the flavour. The principal point to observe in the cultivation of this crop is that throughout the whole season of growth, from the time the seed is sown until growth is finished, the plants ought not to receive any kind of check; and dryness at the root when in a young state, and lack of attention in pricking off the seedlings when ready, are the two principal causes of ultimate failure.

* This article describes the cultivation of Celery as practised in private gardens.

Probably one of the most important items is the sowing of the seed, more especially the date of sowing, for if sown too early the crop may run to flower prematurely, and the flavour is then lost. For the *earliest supplies* to be ready during August and September, sowing should be carried out about the middle of February. A fairly light compost should be prepared, and pots, pans, or shallow boxes used according to the quantity dealt with. After carefully draining and covering the crocks with some good rough material, the pans, etc., should be nearly filled with good loamy soil, which should be pressed level. The seed should not be sown too thickly, and should be just covered with sand or fine soil, watered with a fine rose, covered with a sheet of glass and placed in a gentle heat.

As soon as the seedlings appear they should be placed as near to the glass as possible so that they will continue to grow sturdily, and when large enough they should be pricked off into boxes filled with suitable soil.

The *main sowing* should take place from about the first week to the middle of March and be treated just as the earliest sowing. This will provide plants for use throughout the winter and early spring months, and instead of the whole of the seedlings being transferred to boxes, the greater part should be pricked out into skeleton frames or in a sheltered part of the garden and be thoroughly hardened off before finally placing in the trenches.

The site for the trenches should be marked out and got ready some time in advance, especially on heavy, retentive soils. The trenches should be taken to a depth of twelve or fifteen inches and the bottom be well broken up with a fork. A liberal amount of good half-decayed farmyard manure should be added, filling the trench to within three inches of the top and making firm; sufficient soil should then be placed on the top in which to put out the young plants. For early supplies one row of plants is sufficient in each trench, but for the winter supplies two rows may be accommodated. Planting should take place when the young plants have attained sufficient size, each one being lifted with a trowel, with a good ball of soil attached, so disturbing the roots as little as possible. The plants should be inserted firmly at twelve

to fifteen inches apart, and a good watering in should follow. The plants may be assisted to grow freely by frequent dampings during mild weather, and occasional dustings of soot over and around the plants will do much to stimulate growth and prevent attacks of the celery fly. In hot weather too much water can hardly be applied to the roots, and once the plants are growing freely, stimulants in the shape of artificial and liquid manures properly diluted may be given with advantage. During the growing season the crop should be examined at intervals and all side growths and split leaves removed.

Successive plantings will require similar treatment, and will help to keep up the supply; for the latest plantings it is a good plan to take out a trench between early peas so that the plants may enjoy the shade afforded.

Blanching is one of the most important items in connection with the production of high-class celery, and demands careful attention. It is carried out in two ways, and the method about to be described for the earliest plantings has much to recommend it. Instead of being earthed up in the usual manner, the blanching of the stems is effected by the use of cheap but stout brown paper cut into strips about five inches in width, wrapped round the plants, and secured with a strand of raffia. Further strips may be added at intervals of about ten days. Where good "sticks" are required, this method has much to recommend it, as the plants are very easily watered and fed, and are more free from attacks of slugs and other pests, while the flavour is not in the least affected. It usually takes about six to eight weeks to blanch celery, and for the latest supplies blanching should not be put into operation too early, or the celery will be rendered much more tender and susceptible to frost.

For the blanching of late supplies the method described is useless, and the ordinary method of earthing up should be carried out. Fine weather should always be chosen for the work, when the foliage is dry. A good watering should be given if necessary the day before, and the plants may be prepared by removing all side growths and split leaves. A garden line should be stretched tightly on either side of the row and the soil broken finely and worked well between the plants. Three men may most usefully do the work, one

on either side of the trench and the third to walk backwards and place the soil well around and amongst the plants, keeping the foliage together so that no soil gets between the leaves. Blanching by this method should be done gradually, more soil being added about every ten days until the desired depth is obtained. During severe weather in winter the crowns of the ridges and foliage must be protected, and straw or some other material such as dry bracken may be employed.

For general use Aldenham Pink is a good variety, both for early and maincrop supplies. Invincible White, Standard Bearer, and Major Clark, the two last red varieties, are all excellent, the last named being particularly hardy and useful for late supplies.

THE STERILISATION OF SEED.*

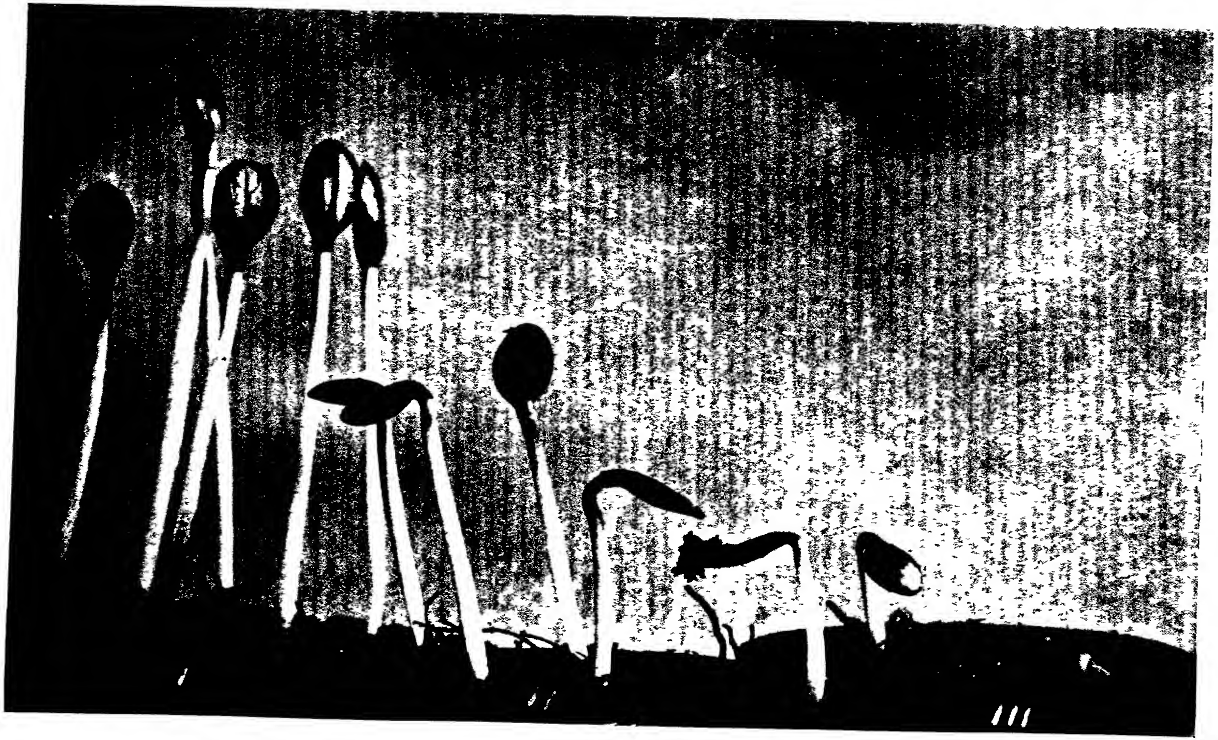
IVY MASSEE.

THE sterilisation of seed is, in many instances, a necessary preliminary to work on plant physiology. Two different methods have been followed: in the one case sterilisation is effected by mechanical means, and the seeds are first washed in a sterilised liquid and then thoroughly shaken up in sand. This method was followed by Mazé in his researches on the development of maize, but is only practicable when the testa of the seed is smooth. The second, and more usual, method is to treat the seed with an antiseptic substance, mercuric chloride being most frequently used. This has proved unsatisfactory for the following reasons: the spores of certain bacteria are resistant to such treatment; the presence of the antiseptic often contaminates the culture medium; and thirdly, the seed tends to be injured if the treatment is prolonged.

Formaldehyde has also been used, but in some cases, as shown by Kehler,† the seeds treated proved more susceptible to injury than the spores of the fungi or bacteria it was sought to destroy.

Owing to the unsatisfactory results of the methods of sterilisation usually employed, de Zeeuw ‡ experimented with various other substances and decided in favour of hydrogen

* From the *Kew Bulletin*, No. 5, 1913 † Kehler, *Dissert. Konigsberg*, 1904.
‡ De Zeeuw, *Centralb fur Bakt.*, 31, p. 4.



STERILISATION OF SEED

FIG 1.—CUCURBITA PEPO. PLANTS AFTER BEING SOWN 5 DAYS

I. Untreated II Treated 4 hours III Treated 24 hours

peroxide (H_2O_2). Pinoy and Magrou * have also experimented with hydrogen peroxide, and give a favourable report of the results.

According to the last-named authors, it was found that after the seed had been immersed in hydrogen peroxide for five hours, all spores were killed, yet the germination of the seed was not much retarded, and in certain instances it was even hastened. Treated seeds of *Orobus tuberosus* germinated in eight days, whereas untreated seeds of the same plant required a month to germinate.

All the above experiments were conducted with the object of obtaining, for physiological research, seeds absolutely free from living germs, more especially bacteria. It was suggested to the writer by her father that the action of hydrogen peroxide on fungus spores and on the germination of seed might prove to be of great value in preventing the spread of plant diseases due to the presence of fungus spores on seed. For the purpose of testing this idea, a series of experiments has been conducted in the Jodrell laboratory. In the first place, in order to test the action of hydrogen peroxide on the vitality of seeds, two batches of seed of each kind experimented on were soaked in hydrogen peroxide for four hours and twenty-four hours respectively, and a control batch, of each kind of seed, was soaked in water for a corresponding length of time. All the soaking was done in closed glass dishes.

In every instance seed treated with hydrogen peroxide was retarded in germination, as compared with seed soaked in water for a corresponding length of time. The germination of the seed soaked in hydrogen peroxide for twenty-four hours was much more retarded than that of the seed soaked for four hours. On the other hand, seedlings from treated seed grew at a quicker rate than those from untreated seed, and, as a rule, within a fortnight were equal in size to or even larger than the plants raised from the untreated seed. Certain kinds of seed were killed after being treated for twenty-four hours. In every instance, except where the treated seed was killed outright, the percentage of germination was equal in treated and untreated seed, and, as a rule, every seed germinated. Fuller details are given in the accompanying table.

* Pinoy and Magrou, *Bull. Soc. Bot de France* 12, n.s., p 609

TREATMENT OF SEED.

Name of seed and number sown.	Time of treatment.	First appearance above ground.	Remarks.
Cucurbita pepo (6)	untreated	4 days	After 8 days plants from treated and untreated seeds were, on an average, of equal size; while after 14 days the batches treated for 24 hrs showed most growth.
	treated 4 hrs	5 ,,	
	,, 24 ,,	6 ,,	
Trichosanthes anguina (6)	untreated	6 ,,	
	treated 4 hrs	7 ,,	
	,, 24 ,,	8 ,,	
Cucumis melo (14) .	untreated	4 ,,	
	treated 4 hrs	5 ,,	
	,, 24 ,,	6 ,,	
Lagenaria vulgaris (6)	untreated	4 ,,	
	treated 4 hrs	5 ,,	
	,, 24 ,,	6 ,,	
Acacia Richii (3)	untreated	7 ,,	
	treated 24 hrs.	killed	
Clitoria glycinoides (3)	untreated	8 days	Treated seed produced feeble seedlings.
	treated 24 hrs	16 ,,	
Caesalpinia pulcherrima (3)	untreated ...	14 ,,	
	treated 24 hrs	killed	
Bauhinia tomentosa (3)	untreated	14 days	
	treated 24 hrs...	killed	
Sweet Peas—			Plants from treated and untreated seeds equal in size 5 days after the treated plants appeared above ground
Evelyn Hemus (10)	untreated	7 days	
	treated 24 hrs. .	11 ,,	
Dainty Spencer (10)	untreated	7 ,,	
	treated 24 hrs.	14 ,,	
Lord Nelson (10)	untreated	7 ,,	
	treated 24 hrs .	killed	
Ricinus communis (2)	untreated	6 days	Plants from treated and untreated seeds equal in size from the first
	treated 4 hrs .	6 ,,	

In testing the vitality of treated fungus spores, very much the same course was followed as that described for seeds. Pinoy and Magrou found that immersion for five hours destroyed all germs present on seeds; but they were mostly concerned with bacteria which are much more resistant to the action of hydrogen peroxide, and to other germicides also, than are the spores of fungi.

Judging from the writer's experiments on fungus spores and on seed, immersion in hydrogen peroxide for three hours is sufficient to kill all fungus spores present on the surface, without, so far as is known, causing injury to the seed.

Batches of a few different kinds of fungus spores treated for half an hour only, showed accelerated germination as compared with spores soaked in water for the same length of time. The following table shows the results:—

STERILISATION OF SEED

FIG. 2.—CUCUMIS MELO. PLANTS AFTER BEING SOWN 8 DAYS

I. Treated 4 hours II. Not treated III. Treated 24 hours

TREATMENT OF FUNGUS SPORES.

Name of spores.	Treatment	Germination.	Remarks.
Ustilago avenae, Jensen	not treated ..	24 hrs	Germination abundant.
	treated ½ hr	all killed	Spores bleached. Protoplasm contracted.
Ustilago Vaillantii, Tul.	not treated	24 hrs .	Hemibasidium formed but not free
	treated ½ hr	24 hrs	More forward than untreated lot.
	,, 2 hrs. ...	3 days	Germination feeble. Many killed
	,, 4 hrs.	all killed	
Uromyces ficariae, DC	not treated ...	24 hrs.	Germination abundant
	treated 1 hr.	all killed	
Aecidium ranunculaceaerum, DC	not treated ...	24 hrs	Germination very vigorous.
	treated 1 hr. .	all killed	
Sclerotinia sclerotiorum, Mass	not treated	24 hrs. .	Did not germinate in water, but freely in decoction of prune juice.
	treated ½ hr ...	all killed	
Leptosphaeria acuminata, Sacc.	not treated ...	2 days ...	Vigorous germ-tube from every cell of the spore.
	treated 1 hr	all killed	
Erysiphe graminis, DC	not treated ...	24 hrs	Germination abundant
	treated 1 hr. ..	all killed	
Macrosporium solani, Cke	not treated	24 hrs	Mycelium rampant in 24 hrs.
	treated 1 hr	all killed	
Heterosporium echinulatum, Berk	not treated	24 hrs. ...	The spores were 3 months old. Germination vigorous
	treated 1 hr.	all killed	
Cladosporium epiphyllum, Pers.	not treated ...	24 hrs	Germination abundant, all put up in decoction of prune juice.
	treated ½ hr.	24 hrs ...	
	,, 2 hrs	all killed	
Verticillium lateritium, Berk	not treated .	2 days ...	Germination vigorous. After 5 days, broken sporophores in the treated batch sprouted vigorously and produced chains of oidia
	treated 1 hr	all killed	

The seed should be treated in closed vessels, bottles, &c., which should be shaken at intervals, otherwise a layer of air bubbles tends to surround the seed and so prevent the action of the fungicide. This method of sterilising seed should prove of value, in addition to home use, in those instances where sterilisation of seed is insisted upon in other countries, and should supersede sterilisation of seed by fumigation, which, although it may be effective against insect pests, is comparatively useless so far as the spores of fungi are concerned. In the event of using this method for sterilising seed, it would

be best in the first case to experiment on a small quantity of seed in order to test the effect of the hydrogen peroxide on the vitality of the seed before treating a large consignment.

It is doubtful whether hydrogen peroxide would prove of value in killing hibernating mycelium which might be present in bulbs, tubers, &c. Only one experiment in this direction has been made, with the mycelium of the *Botrytis* causing the well-known "Lily disease," present in the stem of a lily. Two pieces of lily stem were treated for twenty-four hours, and afterwards the fungus grew freely and produced fruit, while on the control piece of the same stem, soaked in water for an equal length of time, the mycelium grew very slowly as compared with the treated pieces.

The hydrogen peroxide used is known as "commercial, 10 vols." and was not diluted. The price is 5*s*. per gallon. The same liquid may be used for treating several consecutive batches of seed, until its fungicidal action becomes exhausted. It is fit for use so long as it is capable of bleaching a rose-coloured solution of permanganate of potash, to which a few drops of sulphuric acid have been added. (Condy's fluid may be used as a substitute for permanganate of potash.)

Hydrogen peroxide keeps better when the vessel containing it is completely filled; it should also be kept in a cool place, and in the dark. Taking everything into consideration, sterilisation of seed by means of hydrogen peroxide is cheaper and much more effective than by any other method of fumigation known. The preparation of hydrogen peroxide is a simple process, and in tropical countries where its deterioration would be hastened, it would be advisable to have it prepared on the spot.

Summary.—The spores of fungi, and some kinds of bacteria, are as a rule killed by an hour's immersion in hydrogen peroxide; no spores experimented with germinated after similar treatment for two hours.

In nearly every instance the germination of seeds immersed in hydrogen peroxide was retarded. Seeds immersed for four hours were on an average one to two days later in appearing above ground than untreated seeds of the same kind. Seeds treated for twenty-four hours were retarded by from two to eight days. or in most instances were killed outright. The period

of retardation is much less in seeds which germinate quickly than in the case of seeds whose germination is normally slow. After treated seeds have germinated growth is rapid, and in a short time the plants are equal in size and vigour to the plants from untreated seeds sown at the same time. In some cases the plants from treated seeds are distinctly larger than those from untreated seeds at the end of three weeks. For all practical purposes, soaking seed in hydrogen peroxide for three hours will kill all superficial fungus spores and the seed will not be injured. This method is to be recommended as a substitute for fumigation, which, as a rule, does not kill fungus spores, unless continued for such a time as to damage the seed.

Grants for Agricultural Education and Research.

The Report which has just been published on the distribution of Grants for Agricultural Education and Research in the year 1912–13 * shows a considerable increase in the amount expended by the Board for these purposes. The total amount distributed as grants for Agricultural Education and Research in the financial year 1912–13 was £34,325. In the preceding five years the corresponding sums were:—1907–8, £12,480; 1908–9, £12,910; 1909–10, £12,900; 1910–11, £19,265; 1911–12, £28,690. The grants paid in 1912–13 included a sum of £12,935 from the Development Fund, the corresponding sum in 1911–12 being £9,600. The large increase in the amount expended since the year 1910–11 is accounted for by the grants which are now being made under Development Fund Schemes in aid of research and advisory work carried on at universities and colleges, and also by the payments to Research Scholars in Agricultural Science.

Aid for Experiments and Research.—From 1890, when the Board first made grants for agricultural education, until 1910, a good deal of experimental work had been carried on by teaching institutions, but the specific grants in aid were very small, and investigations were conducted by men who were primarily engaged as teachers. In reporting on the grants made in 1909–10, which amounted to no more than

* Report on Grants for Agricultural Education and Research [Cd 7179]

£600 for the whole of Great Britain, Mr. Middleton remarked that much of the original work in agricultural science then in progress was being carried on free of cost to the public by underpaid junior teachers. In the present report he points out that this state of affairs, while creditable to the teachers themselves, was not good for agriculture, and that this fact was recognised by the framers of the Development Act. "Aiding and developing agriculture and rural industries by promoting scientific research" is the first-mentioned object to which the Act indicates that Development Funds may be applied.

Grants from the Development Fund for Experiments and Research were available in 1911–12, the total expended in that year being £9,263. The grants in 1911–12 were, however, of a tentative kind, and had been approved by the Development Commissioners so that progress might be made with scientific inquiry while schemes for the organisation of agricultural research were under consideration. An agreement between the Board and the Commissioners as to the general principles on which aid for Research should be distributed was come to in 1911, and the Scheme was finally approved by the Treasury on the 21st August, 1911.

Grants in aid of "Research Institutes" are payable only to certain institutions approved by the Development Commissioners. These institutions are required, as a condition of grant, to specialise in particular branches of agricultural science. "Special Research Grants" are payable on the recommendation of the Advisory Committee in Agricultural Science. Grants for "Advisory Work and Local Investigations" are payable, like the Research Grants, to approved institutions, on condition that each undertakes work in a group of counties arranged by the Board. The groups of counties form Educational Provinces, and one of the purposes of the Advisory Councils which have been set up in each province is to ensure that the services of the consultative chemists, botanists, entomologists or other scientific experts employed under the Advisory Scheme are utilised by the counties.

The greater part of the expenditure on experimental work will be through the recognised Research Institutes. When all of them are in full working order the grants now contemplated will amount to about £30,000 per annum. For institutions

approved as Advisory centres, £12,000 per annum will be available. The total sanctioned for Special Research Grants for England and Wales amounted to £3,000 per annum, but under the arrangement which extends the scope of the Advisory Committee to Scotland, the grant has now been fixed at £4,000 for Great Britain.

New Buildings.—In the Scheme for the endowment of agricultural research agreed upon by the Board and the Commissioners, it was settled that grants in aid of capital expenditure would be made in addition to grants for annual maintenance. The housing of a number of additional workers would obviously involve laboratories, equipment and special apparatus. When institutions surveyed their needs in respect of accommodation, it was found in many cases that additional class-room accommodation was necessary, and several applications for aid in the erection of buildings to be used partly for teaching and partly for research were received. A number of grants have been sanctioned for schemes involving capital expenditure. In nearly all cases capital grants are conditional on an equal sum being provided by the governing body of the institution aided. The grants for buildings and equipment are made by the Treasury to the institutions aided *through* the Board.

Little new work has so far been possible at the Research Institutes, and in most cases so many administrative duties connected with the erection and equipment of new buildings have fallen upon those responsible for the direction of research that difficulty has been experienced in carrying on the work already in hand. Good progress has, however, been made with these initial undertakings. A laboratory and a farm have been added at Rothamsted, and accommodation, much needed for the new lines of work opening up at that station, has thus been provided; but so rapidly has the scope of the work of Rothamsted extended in recent years, and the additions to the staff have been so numerous, that a further building programme has already been taken in hand, and in this particular case some time must elapse before the Director is free from the hindrances to research inseparable from rapid expansion.

During the year an extension of the School of Agriculture

was begun at Cambridge, which will almost double the accommodation of this building completed so recently as 1910. A second farm has also been acquired by the University for the purposes of the Plant Breeding Institute. The University of Oxford is adding to its School of Rural Economy. A new biological department has been built at the Imperial College of Science and Technology, and a part of this building has been set apart for the purpose of a Research Institute in Plant Physiology. The University of Bristol has acquired a site for the new Research Institute for Fruit-growing at Long Ashton, and considerable progress with the building of a laboratory and cider-house has been made, while the Universities of Manchester and Birmingham have adapted existing buildings for work in Agricultural Zoology.

Similar progress has been made in providing for the accommodation of the consulting experts to be employed on Advisory work. The Governors of Wye College have added new laboratories. Armstrong College has built new laboratories and classrooms for the Agricultural Department. The Governors of the Seale-Hayne College have begun the erection of the buildings for this Institution, and structural alterations have also been made by the Councils of the Colleges at Aberystwyth and Bangor in preparation for the additional work undertaken by their agricultural departments.

Investigations of Local Problems.—Ever since the higher teaching institutions have come into existence they have been consulted by agriculturists in cases of difficulty, and usually by the best and most progressive farmers. Lack of funds has hitherto prevented the institutions devoting so much time as is desirable to the important duties connected with this side of their work. In the Scheme originally prepared by the Board, it was assumed that the staffs of the existing institutions would be largely employed in such consultative work, and it was estimated that if after a period of years the existing staff at each of twelve centres was increased by four men who had received a first-rate scientific training, the needs of the country would be provided for. The Development Commissioners approved the Board's proposal in part only, and they agreed to the addition of two of the four suggested experts at each centre. As the Board estimated that the full number of

forty-eight appointments could not be made for five or six years after the Scheme came into operation because of the lack of suitable men, the Advisory Scheme approved by the Commissioners provides all that is required for the present. The appointments have been sanctioned in most areas, but it will necessarily take some time to complete arrangements for all the appointments contemplated.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

MANURES.

Experiments with Artificial Manures in Sweden, 1912 (*Biedermann's Centralblatt, Sept.,* 1913).—The Central Agricultural Experiment Station in Sweden carried out in the course of 1912 a number of experiments with various artificial manures.

Experiment No. 1 was undertaken in order to ascertain the value of the phosphoric acid contained in a new artificial manure, phosphatic-nitrate, produced by the "Norsk Hydro-Elektrisk Kvalstofaktieselskap." The phosphatic-nitrate is obtained by treating raw phosphates with nitric acid, and contains 26.35 per cent. total phosphates, 23.8 per cent. citric soluble phosphates, 3.1 per cent. nitrates, and about 30 per cent. lime.

The experiment was carried out in glass vessels filled with sand, to which had been added a suitable nutrient medium. Amounts of phosphatic-nitrate and superphosphate containing phosphoric acid equivalent to about 70 lb. and 140 lb. per acre in each case were then added. Some Storm King oats were sown on April 26th, and harvested on August 5th. The results obtained showed that there was little to choose between the effects of the phosphoric acid from the application of the smaller amounts of the two manures, but that with the larger applications somewhat larger returns were obtained from the phosphatic-nitrate, especially as regards production of grain.

In Experiment No. 2 some new nitrogenous manures were compared. The manures used were nitrate of lime from Notodden (13.3 per cent. nitrogen); basic nitrate of lime derived from the absorption of nitrogen gases by ground lime, and containing 11.7 per cent. nitrogen and 40.93 per cent. lime; and granulated calcium cyanamide prepared in a special way containing 14.3 per cent. nitrogen. Nitrate of soda and sulphate of ammonia were used for the purpose of comparison.

The vessels, soil, and nutrient medium were as in Experiment No. 1. Some finely-powdered marble and basic slag were also added. Two series of experiments were carried out. In the first, amounts of the

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

different manures, each containing nitrogen equivalent to 70 lb. per acre, were mixed with the soil to a depth of 7 inches a week before sowing. This was repeated with double the quantity of each manure. In the second series the smaller application of manures only was given as a top-dressing nine days after germination. The Storm King oat was again sown.

The following tables show the results obtained, nitrate of soda being taken as 100. With the smaller application of manures the results were :—

	Total.	Grain.	Straw.
Nitrate of soda	100·0	100·0	100·0
Nitrate of lime	96·5	96·4	96·5
Basic nitrate of lime	105·7	106·4	105·2
Sulphate of ammonia	104·7	98·2	109·5
Calcium cyanamide	64·3	64·3	64·3

With the larger application of manures the results were :—

	Total	Grain.	Straw.
Nitrate of soda	100·0	100·0	100·0
Nitrate of lime . . .	86·6	87·8	85·6
Basic nitrate of lime .	81·5	83·9	79·4
Sulphate of ammonia .	104·6	105·8	103·5
Calcium cyanamide	57·7	57·0	58·3

Where the smaller application of manures was given as a top-dressing the following results were obtained :—

	Total.	Grain.	Straw.
Nitrate of soda	100·0	100·0	100·0
Nitrate of lime	94·7	92·0	96·7
Basic nitrate of lime	87·8	85·7	89·3
Sulphate of ammonia	86·4	86·9	86·0
Calcium cyanamide . . .	29·2	27·8	30·0

In the first series it will be seen that, with the smaller application, the basic nitrate of lime was found to produce on the whole the best results, but with the larger application the sulphate of ammonia was most effective.

When the manures were applied as a top-dressing nitrate of soda and nitrate of lime were shown to give the best results.

The returns obtained from applying the manures previous to sowing were greater than when applied as a top-dressing in the case of sulphate of ammonia, basic nitrate of lime, and calcium cyanamide, and less with nitrate of soda and nitrate of lime.

The poor results obtained from the calcium cyanamide were incon-

sistent with those obtained in previous experiments, but in the experiment under consideration the special preparation of the manure may have rendered it less readily assimilable.

Experiment No. 3 was carried out to test a French radioactive manure which was found on chemical analysis to be a combination of potash, alumina, and silica. The manure showed a weak radioactivity and proved harmless, but had no positive effect with an ordinary application. With an abnormally large application the yield was very slightly increased.

Experiment No. 4 compared the value of nitrate of soda and sulphate of ammonia as manures for turnips. It was found that the results obtained from the use of the sulphate of ammonia were markedly superior to those obtained from the nitrate of soda. This was in keeping with observations made on previous occasions.

In Experiment No. 5 the effects of pulverised Stockholm granite as a manure were examined. As expected, the meal was found quite sterile as regards nitrogen. As a phosphatic manure it produced a small, but still noticeable, increase in the yield. The granite meal was shown to contain sufficient potash and lime to meet the requirements of plants, and it was concluded that with a nitrogenous and phosphatic manure added to the meal further manuring would be superfluous.

LIVE STOCK AND FEEDING STUFFS.

Ovariotomy in Sows; with Observations on the Mammary Glands and Internal Genital Organs (*Jour. of Agric. Sci., Oct.,* 1913; *K. J. J. Mackenzie, M.A., and F. H. A. Marshall, Sc.D., School of Agric., Cambridge*)—In this paper evidence is given to show that the black pigment frequently found in the mammary tissue of sows, and which renders the bacon less saleable, is not associated (at any rate, directly) with the occurrence of heat. The possibility of breeding strains of Berkshire or of other coloured pigs in which there would be no melanic pigment in the bacon cut from the mammary region, is indicated. Such a strain would have an increased commercial value. It is stated that if the presence of black pigment is not in itself objectionable, and if it is only the changes in the mammary area due to the occurrence of heat, which are not desired, the remedy is to be sought in efficient spaying, a description of which is given.

The Value of Roots for Wintering Young Store Cattle (*Journ. Dept. of Agric. for Ireland, October,* 1913).—Experiments were conducted for three seasons at the Athenry and Ballyhaise Agricultural Stations to ascertain the effect of replacing 1 lb. of mixture consisting of equal parts of linseed cake, crushed oats, and maize meal with 1 stone (14 lb.) of roots in an average winter ration for calves. In each experiment two lots of calves of an average age of approximately nine months, and as even as possible in every respect, were treated exactly alike except as regards the amount of roots and concentrated foods given. The daily ration per head was as follows:—

Lot I.	Lot II.
2 stones roots	1 stone roots
2 lb. cake and meal mixture	3 lb. cake and meal mixture

During the early part of the winter Aberdeen yellow turnips were

used; subsequently these were replaced by swedes. At Ballyhaise the fodder consisted entirely of hay; at Athenry oat straw was fed part of the time, and hay during the remainder. The special feeding lasted from about the middle of November till the calves were turned out in spring. The calves were housed during the whole period The average results of the experiments are given in the following table.—

	Average No of days fed.	Av. weight at beginning	Av weight at close	Av. increase.	Av daily increase.
		cwt. lb	cwt lb.	cwt. lb.	lb
Lot I (2 stones roots, 2 lb cake and meal)	154 4	4 0	5 70	1 70	1·18
Lot II. (1 stone roots, 3 lb cake and meal)	154 4	3 111	5 73	1 74	1 20

If the prices of linseed cake, crushed oats, and maize meal are taken as 10*s.* 6*d*, 6*s.* 8*d.*, and 7*s.* 6*d.* per cwt. respectively, the mixture costs 8*s.* 3*d.* per cwt., and one-fourteenth of this, viz., 7*d.* per cwt., or 11*s.* 8*d.* per ton, is the value of the roots.

In these valuations, however, no account has been taken of the manurial values of the foods. The manurial value of the cake and meal mixture is about 20*s.* per ton, and that of roots 2*s.* 8*d.* per ton, or 37*s.* for 14 tons It is suggested that the greater manurial value of the roots might be set against the extra labour involved in handling this feeding stuff. In conclusion, it is stated that under conditions similar to those observed in these experiments it would appear that for young store cattle 1 st of roots is equal in feeding value to 1 lb. of a mixture of equal parts of linseed cake, crushed oats, and maize meal.

Calf-Rearing (*Kentucky Agric Expt. Sta., Bull No.* 171).—In order to ascertain whether nipple- or bucket-feeding of calves was the better method to adopt, five tests were made with eighty calves In one lot in each test the calves were supplied with milk direct from the bucket, while those of the second lot sucked the milk through nipples or "calf feeders." The several lots of calves were equal in respect of age, sex, weight, and condition, and all the calves received the same amount of food.

It was found that while the bucket-fed calves took, on an average, 39½ seconds to drink their milk, those fed through the nipple required 2 minutes 21 seconds. During the first seven to ten weeks the nipple-fed calves were more thrifty than those fed from the bucket

It is stated that calves fed carefully from the bucket will make almost as much growth by the time they are six months old as those fed on the nipple when they are young.

Calf-Rearing (*Univ. of Illinois Agric. Expt. Sta., Bull. No.* 164; *Welber J. Fraser and Royden E. Brand*).—In this bulletin the authors observe that there is a great scarcity of deep milking cows at the present time, and that the most economical and most satisfactory way for dairy farmers to increase the efficiency of dairy herds is to use a good pure-bred dairy sire and rear the heifers from their best cows. The majority of dairy farmers consider calf-rearing too costly in districts

where whole milk is sold. The prevalence of the undesirable practice of selling calves, especially heifer calves from superior cows, for veal, together with the fact that the amount of milk required to give calves a good start is the economic question that determines the extent to which rearing is practised, has led the Department of Dairy Husbandry to undertake an experiment to determine the minimum amount of whole and of separated milk required to raise a calf successfully. Three tests were conducted, in which different amounts of whole and skim milk were used. The supplementary foods were oats, maize, bran, linseed meal, and clover hay. It was found that calves could be successfully reared when supplied with 137–167 lb. whole milk, together with 378 to 491 lb. separated milk. Calves require a fairly good start on whole milk for three weeks, and after this the whole milk may be successfully replaced by separated milk, fed sweet and warm as it comes from the separator. The substitution, however, must be gradual. The calves should then receive 12 lb. of separated milk per day for the next four weeks, after which the amount may be gradually reduced until, when the calves are eight weeks old, the milk may be discontinued. It is stated that lucerne hay is an excellent food for calves, and should be available on every rearing farm.

Feeding Farm Horses (*Report of the Kansas State Board of Agriculture,* 1913).—Experiments were conducted at Illinois Experiment Station with the object of ascertaining the relative values of various rations for farm-work horses with respect to the following points: (1) maintenance of weight; (2) health, spirit, and ability of horses to endure hard work. The economy of each ration was also considered. The following were some of the conclusions reached:—

1. Clover hay is quite as efficient as, if not a little superior to, timothy hay for horses at hard work, when a mixed ration of maize, oats, oil meal, and bran is fed.

2. Both kinds of hay had a similar effect on the spirit of the horses. Those receiving clover, however, had a glossier coat.

3. When clover is used as a horse food the quality should be good and a limited quantity should be fed.

4. Where lucerne hay is the fodder supplied to farm horses at hard work, less grain is necessary to prevent them from losing weight than where timothy hay is fed.

5. A saving of about 10 per cent. may be made by grinding the grain of farm horses when at hard work.

6. Farm horses at hard work should receive 1¼ to 1⅓ lb. of grain, and from 1 to 1¼ lb. of hay, per 100 lb. of live weight per day in order that their weight may be maintained.

DAIRYING.

Cheddar Cheese Investigations and Experiments (*Ontario Agric. Coll. Report,* 1912).—The Report of the Professor of Dairy Husbandry contains an account of a series of investigations and experiments which were carried out at representative cheese factories in the province. Amongst other conclusions reached are the following:—

The average weight of green cheese made from 1 lb. of fat and casein in the milk was 1·59 lb. The average weight of milk required

to make 1 lb. of cheese was least in October, viz., 9·68 lb., and highest in August, viz., 11·43 lb.

Over-ripe milk of similar composition to that in a normal condition produced 2·2 lb. less cheese per 1,000 lb. of milk. Cheese made from the over-ripe milk contained the same percentage of moisture as that made from the normal milk, but its quality was inferior in every case.

While an average increase of 0·027 per cent. of acid in the milk at the time of adding the rennet affected neither the yield nor the quality of the resulting cheese, the same increase of acid in the whey at the time of removal of the curd reduced the yield of curd by 0·4 lb. per 100 lb. of milk. These acid curds contained less fat and moisture, and produced slightly inferior cheese, than the milder ones. As the amount of salt added to the curd was increased the moisture content of both green and ripe cheese was slightly decreased.

Cheese ripened in the cold-storage at 40° F. retained more of the original moisture in the cheese at the end of one month than did the cheese ripened in the ordinary ripening room at 60–70° F., and was superior in quality. The loss of moisture took place chiefly from the first inch of the cheese; the amount of moisture in the centre of the cheese remained fairly constant for at least a month; the greatest loss took place during the first week of ripening.

Milking Machines: Their Sterilisation and their Efficiency in Producing Clean Milk (*Cornell University Agric. Expt. Sta., Dept. of Dairy Industry, Circ. No* 18; *Lois W. Wing*).—Experiments were carried out in order to test the efficiency of milking machines in securing a high grade of milk and to determine the amount of care necessary to keep them in a sterile condition. It was found that when the pails and tubes of milking machines were washed with hot water and washing powder, placed in a brine containing about 15 per cent. of salt and rinsed with hot water immediately before being used, the bacterial content of the milk drawn by them was high. On making a bacteriological analysis of the brine, it was found to be a source of contamination. When a solution consisting of water 7½ galls., salt 10 lb., chloride of lime ¼ lb., was substituted for the brine, the tubes and teat cups were rendered practically sterile and milk with a low germ-content was obtained. It was found to be necessary to add fresh chloride of lime once a week in order to maintain a solution of effective strength

HORTICULTURE

The Composition of Irrigated and Non-Irrigated Apples (*Jour. of Agric. Sci.*, 1913; *J. S. Jones and C. W. Colver, Lab. of Agric. Chem. Univ. of Idaho, U.S.A.*).—It is generally believed that irrigated fruits are inferior to non-irrigated fruits as regards taste and power to resist the various agencies which effect decay, and in support of this belief it is frequently stated that the former contain abnormally high percentages of water, and consequently low percentages of dry matter, and are therefore deficient in those compounds which determine the taste and body of the fruit. Although the quality of fruits may not be capable of determination from analysis alone, it would appear that, in so far as taste depends upon the presence of certain compounds, analytical data would be of material service in the settlement of questions relating

to quality. In the experiments described in this paper the irrigated samples of apples were obtained from parts where irrigation is imperative, and the non-irrigated samples from districts where the annual rainfall varies from 25 to 35 inches. Determinations were made of total solids, acids, sugars, nitrogen, ash, and waste in several varieties, when they were in a condition similar to that in which they reach the retail trade. It was found that the differences between the irrigated and non-irrigated in total sugar and acid were so small that in the analytical data obtained there was no substantial basis for the claim that the irrigated apple is inferior in taste.

Marketing of Fruit (*Journ. Dept. of Agric. for Ireland, October*, 1913).—This article deals with the harvesting, grading, packing, and marketing of apples, strawberries, raspberries, currants, gooseberries, plums, cherries, and damsons. Growers are reminded that successful marketing depends largely on good grading and careful packing in such a manner that the fruit will not suffer if carefully handled in transit, and that it shall present an attractive appearance when offered for sale.

Effect of Partial Sterilisation of Soil on Tomatoes (*Ontario Agric. Coll. Report*, 1912).—Experiments were conducted in which tomato plants were grown in partially sterilised and unsterilised soil. The following results were obtained:—

140 plants grown on sterilised soil produced 936·6 lb tomatoes = 6·69 lb. per plant.

40 plants grown on unsterilised soil produced 176·9 lb. tomatoes = 4·42 lb. per plant.

FORESTRY.

Experiments in the Preservative Treatment of Red-Oak and Hard-Maple Crossties (*U.S. Dept. of Agriculture, Forest Service, Bull.* 126; *Francis M Bond*).—In this communication the author describes the treatment of railway ties and gives the data obtained from the application of various preservatives. A description of the laying of a test track is also given, together with tabulated records essential for an analysis of the durability data which will be obtained in future inspections.

Avondale Forestry Station (*Journ. Dept. of Agric. for Ireland, October*, 1913; *A. C. Forbes, F.H.A.S., M.R.I.A.*).—In 1903 the Department took steps to establish a school for working foresters in which young men could be trained in the various operations connected with the formation of plantations and their subsequent care and management. The Avondale Estate (near Rathdrum, County Wicklow) was purchased for this purpose. Besides being a training centre for foresters, one of the chief objects of the station is to furnish information on the economic value of many recently introduced species of forest trees which have not hitherto been planted on sylvicultural lines, and also to ascertain, so far as is possible in one place and on a limited area, the cost of production, yield of timber, and comparative market value of the species planted. The author deals with the general features of the station, buildings and equipment, the suitability of the site for tree growth, the climate, soil, arrangement of experimental plots, methods of mixing and grouping, origin of plants; methods of planting, cost of planting, and progress made by the various plots up to the autumn of 1912

WEEDS, INSECT AND FUNGUS PESTS.

Finger-and-Toe in Swedes (*Northumberland County Educ. Com.; Guide to Agric. Expt. Sta., Cockle Park,* 1913).—In order further to test the relative values of various forms of lime as preventives of finger-and-toe in swedes, a new set of plots was put down for 1911. Land which had been four years under grass, after receiving four tons of lime mud per acre, was ploughed for oats in December, 1909. All the lime dressings were applied in a dry powdery condition when the swedes were sown on May 11th. They were evenly spread over the open drills, which were then immediately closed. The various treatments, together with their respective results, are given in the following table:—

Plot.	Dressing per acre	Weight of Swedes per acre. 1912		Weight of Swedes per acre. Average of two years		1912 Percentage of Roots. Sound	1912 Percentage of Roots. Slightly Diseased.	1912 Percentage of Roots. Badly Diseased.
		tons	cwt.	tons	cwt.			
1	2 tons ordinary lime (90 % CaO)	20	8½	19	1½	70·5	16·8	12·7
2	2 tons ground lime (= 2 tons ordinary lime)	18	7¼	18	14½	76·9	15·9	7·2
3	1 ton ground lime	19	1½	19	3¼	78·3	16·3	5·4
4	3⅛ tons ground limestone (= 2 tons ordinary lime)	21	5	20	5¾	81·9	13·5	4·6
5	1⅝ tons ground limestone (= 1 ton ordinary lime)	14	1½	17	2½	79·5	16·7	3·8
6	No dressing	15	19¾	17	12½	71·8	22·9	5·3
7	1¼ tons hydrated lime (= 1 ton ground lime)	14	16½	15	18¼	81·1	11·2	7·7
8	2⅛ tons dried gas lime (= 1 ton ground lime)	10	2½	14	14	84·9	10·3	4·8
9	2 tons dried lime mud (= 1 ton ground lime)	—		16	11¾	—	—	—

Preventive Measures against Wireworms (*Fuhlings Landwirtschaftliche Zeitung, Oct. 1st,* 1913).—This publication gives an account of some experiments carried out at the Agricultural Institute at Jena in order to test the measures usually recommended for combating the attacks of wireworms. A number of field trials were first undertaken. From these it was concluded that rolling, which is often recommended as hindering the movements of the wireworm, produces little or no useful effect. Kainit also met with no success, but, owing to the weather being very dry, the experiment was hardly conclusive. For gardens and small pieces of ground the use of pieces of potato as traps was found to be the most effective measure for ridding the land of both wireworms and millipedes. Five or six pieces of potato were distributed over each square yard of ground, and replaced by fresh pieces every two days. In this way about 10,000 to 12,000 wireworms, and 6,000 to 8,000 millipedes, were caught per acre.

With the wireworms caught some laboratory experiments were carried out, the conclusions arrived at being as follows:—

Cotton seed meal is not in any way harmful to wireworms.

Carbon bisulphide is too expensive for general use, as considerable quantities are required.

Kainit has practically no effect, as the wireworms soon become accustomed to it.

A very damp soil is distasteful to them.

The best general preventive measure is to adopt cultural methods which will promote a quick, strong development of the plants, while for small areas of ground potato traps are of great use.

Loose Smut in Oats and Stinking Smut in Wheat (*Ontario Agric. Coll. Report,* 1912).—Experiments designed to ascertain the best treatment for these diseases have been conducted for five years in succession. The following are the treatments which were employed throughout, with the exception that numbers (3) and (6) were not tried in the case of winter wheat.

(1) Untreated.

(2) Immersion for a short time in water at about 115° F., and subsequent immersion for 15 minutes in water at a temperature of between 130° and 135° F.

(3) Immersion for five minutes in copper sulphate solution; strength: 1 lb. in 1 gallon of water.

(4) Immersion for 12 hours in copper sulphate solution; strength: 1 lb. in 25 gallons of water.

(5) Sprinkling with copper sulphate solution; strength: 1 lb. in 10 gallons of water.

(6) Immersion for two hours in potassium sulphide solution; strength: 8 lb. in 50 gallons of water.

(7) Immersion for 20 minutes in a solution of formalin; strength: half pint in 21 gallons of water.

(8) Sprinkling with a solution of formalin; strength · half pint in five gallons of water.

The following table and the table on p. 814 give the average percentage of smut and the average yield of grain per acre ·—

TREATMENT OF OATS FOR SMUT.

Materials	Percentage of Smut	Average yield of Grain per acre
		bushels.
1. Untreated	5 7	60·3
2 Hot Water	0 0	63 7
3 Copper Sulphate .. 5 minutes	0 8	58 5
4. ,, ,, ... 12 hours	0 1	56·0
5 ,, ,, (Sprinkled) ...	1·3	61·8
6. Potassium Sulphide	0 2	66·2
7. Formalin (Immersed)	0·0	68·3
8. ,, (Sprinkled) ...	0 0	61·3

It will be seen from the tables that of the several treatments adopted the one in which the grain was immersed for 20 minutes in a solution of formalin (half a pint in 21 gallons of water), gave the best results with both oats and winter wheat.

TREATMENT OF WINTER WHEAT FOR SMUT.

Materials.	Percentage of Smut.	Average yield of Grain per acre.
		bushels.
1. Untreated	4·2	38·0
2. Hot Water .	0·0	40·6
4. Copper Sulphate . 12 hours	0·0	40 2
5. ,, ,, (Sprinkled) ...	0·1	41 1
7. Formalin (Immersed)	0·0	43 3
8. ,, (Sprinkled)	0 0	36·3

MISCELLANEOUS.

Germination Experiments on Old Seeds (*the following note has been communicated to the Board by Mr. Gervaise Turnbull, F.L.S.*).—Leguminous seeds after a certain time, like grass seeds, appear to have a reduced germinating capacity. An extreme case is afforded by some experiments made by the writer on clover seed of various kinds, gorse, weed grass, and other grass seeds, and some of the commoner weeds. The leguminous seeds and those of the useful grasses were at least 14 years old, while the weeds and weed grasses were 12–14 years at least. The former were above suspicion as to quality, and the latter were for the most part harvested and preserved by the writer with great care, the seeds being kept in corked bottles.

Clovers, &c., comprised Dutch, yellow suckling clover, gorse, kidney-vetch, and trefoil, and of these the yellow suckling clover showed the lowest vitality. At a temperature of about 60° F. there was a very small percentage of germination at two days, 3 to 5 per cent. being reached in six days by gorse, kidney-vetch, and trefoil, 12 per cent. and 4 per cent. being reached by trefoil and Dutch respectively in eight days. Trefoil and gorse were the most robust, and many of the seeds in the samples of these two species showed some signs of life, although too weak to germinate properly. Suckling clover germinated under 1 per cent. Dutch came next to trefoil and gorse in vitality. The good grasses were markedly later in starting, and showed a much higher germinating capacity, although they were very weak, and made no further progress. Most of the tall and meadow fescue, foxtail, rye-grass, and cocksfoot began to germinate in three weeks, as did hard and sheep's fescue, though less satisfactorily. Meadow grasses and timothy did not germinate, and of the others the seedlings were too weak to live. The weed seeds included meadow saffron, common knot-grass, foxglove, nettles, corn cockle, and yarrow, and were extremely poor in germination, yarrow being dead, and cockle most active. Weed grasses comprised couch, *Bromus inermis*, and *B. asper*, and began to germinate freely in fourteen days, but the seedlings were also weak and made no more progress. The trial was carried on for six or seven weeks, but with no further result, and not one weed or grass germinated properly.

NOTES ON AGRICULTURAL CO-OPERATION.

The Organisation of the Dairying Industry.*

The question of the production of pure milk is one of the most important agricultural problems of the present day, and it is a matter that can best be dealt with in connection with the organisation of the dairy industry on co-operative lines. Many methods have been suggested from time to time to solve the various related problems, but these have usually involved the application of compulsory measures which would in many cases be distasteful to those principally concerned. Improvements can be effectively and economically carried out by the milk producers voluntarily co-operating to comply with conditions necessary to ensure the supply of milk which is pure and free from contamination.

Considerable progress has been made in other countries in obtaining a pure milk supply, especially in Denmark, where the work of the well-known Copenhagen Pure Milk Company has yielded such good results, and in America, where a large proportion of the milk sold is "certified." In this country much attention has already been paid to the organisation of dairy farmers to ensure their produce being dealt with in the best and most economical ways, and considerable progress has been made.

Extent of the Co-operative Movement as Regards Dairying.—The most important feature of the work of many of the societies affiliated to the Agricultural Organisation Society consists in the disposal of dairy produce on co-operative lines, and there were at the end of March, 1913, about thirty societies who regard this work as their principal object. The amount of milk dealt with by these societies is estimated at about 55,000 gallons daily, or about 20,000,000 gallons per annum.

Methods Adopted by Dairy Societies—Advantages.—The methods adopted by the societies vary largely according to local conditions. Where there are good transit facilities to markets and consuming centres the usual procedure is to dispose of the members' produce as far as possible as whole milk, and thus continue, on co-operative lines, the practice previously followed by the individual farmer. The chief difference is that by reason of the larger amounts being dealt with by a dairy society, it is possible to regulate to a considerable extent the amount of milk which is being sent to the consuming public, and thus avoid overloading the market with supplies and causing a fall in prices. Where a number of individual farmers are supplying a consuming centre with milk it is not possible for each profitably to convert any surplus milk he may have into a product which would relieve the congested state of the market and so prevent a fall in the price. On the other hand, the combined surplus milk of these farmers can profitably be dealt with through a co-operative depôt, and this constitutes one of the advantages of these societies.

Another important advantage is that the farmer is relieved of the trouble and expense of marketing, and can devote his whole time and knowledge to the actual farming operations necessary for production. He is not troubled with bad debts and other similar drawbacks, the

* Communicated to the Board by the Agricultural Organisation Society.

co-operative society undertaking all the work in connection with marketing through a responsible and efficient manager. The society can also make inquiries as to the financial stability of customers with much greater ease and certainty than an individual farmer.

A further great advantage, however, is that the farmer, through his society, retains that portion of the profits which formerly was secured by unnecessary intermediaries, these men being dispensed with on the advent of the society, the object of which is to place producer and consumer in the closest possible touch. After the necessary deductions have been made for the payment of interest on capital and to cover working expenses, the profits are returned to the members in the proportion of the amount of trade done by each. Interest on share capital in co-operative societies registered under the Industrial and Provident Societies Act is limited—usually to about 5 per cent. This fact, in conjunction with a provision of the Act that no shareholder can hold more than two hundred pounds worth of shares, prevents a co-operative society becoming a capitalistic concern.

Cooling and Cleansing of Milk.—Nearly all the co-operative dairy societies affiliated to the Agricultural Organisation Society dealing with whole milk are fitted up with the most up-to-date plant for proper cleansing and cooling of the milk produced by the herds of the members. The condition of the members' farms is often examined to ensure cleanliness in production, and this constitutes a great advantage to the retailer and the consumer, rendering it possible for them to obtain pure milk which can be relied upon.

The Question of Dealing with Surplus Milk.—There are various ways in which surplus milk is being profitably dealt with by dairy societies in this country, amongst them being the manufacture of cheese, and the manufacture of separated milk powder in conjunction with the sale of cream. It has been found that the making of butter from surplus milk in the majority of cases is not so profitable. The great advantage of dealing with surplus milk through a co-operative society is, as has already been indicated, that the market is not flooded with large supplies which cause prices to fall.

The Work of Societies having no Milk Depôt.—Several societies, whilst not directly dealing in milk and other dairy produce, have greatly assisted their members by placing them in touch with suitable markets.

The Manufacture of Stilton Cheese.—Two dairy societies have been established in Leicestershire, with the primary object of manufacturing Stilton cheese. The success of these societies completely refutes the old idea that this cheese can only be well and profitably made from the milk of separate herds, and not from the mixed milk of several herds. Cheese-making operations are carried on in the summer months only; during the winter the milk produced by the members is largely sold as accommodation milk, for which a good price is obtained.

Butter-making.—The manufacture of butter is being carried out by two co-operative creameries in Cornwall, and two similar societies which have recently been established in Northumberland will probably shortly commence business. In each of these cases, owing to the distance from markets and to inconvenient transit facilities, butter-making is the only feasible way of dealing with the milk produced. It has been found that the cost of manufacture to the farmers is very much

less when done on co-operative lines, that the returns are greater owing to the fact that there is less wastage, and that a more uniform butter is produced by an expert creamery manager than can be produced by individual farmers, no matter how clever they may be as butter-makers.

The method usually adopted is for the farmer to separate his own milk, and either to send in his cream, or have it collected by the society two or three times a week. At the creamery it is graded according to quality, properly ripened, and made into butter. The cream is paid for on the basis of its fat content, and on its quality as regards freshness and cleanliness.

Butter Blending.—An alternative to the preceding plan has been adopted by one society in Wales; here the farmers make the butter themselves, and send it unsalted in a granular or semi-granular form to the premises of the society, where an up-to-date blending plant has been installed.

The Production of Pure Milk.—The production of pure milk is a feature to which some of the dairy societies have devoted special attention, and there is great scope for further work in this direction. One society in the north of England in particular has specialised in the sale of milk produced from cows which have been tested for tuberculosis and certified free from this disease. The milk is dealt with at the society's depôt in the most cleanly manner possible, and bottled for consumption in the large industrial towns of the north, where it secures a ready sale. The question of the production of pure milk from disease-free cows is one which is now being considered to a greater extent than formerly, and it is certainly a phase of farming to which the principles of co-operation can be easily applied in order to bring out the best results.

A Retail Dairymen's Society.—A new departure in co-operative enterprise is the establishment of a society by retail dairymen in London to provide them with a means of safeguarding their own interests, and also, incidentally, to assist in the elimination of unnecessary middlemen and to retain the profits. The society has in the past largely obtained its supplies of milk from other dairy societies affiliated to the Agricultural Organisation Society. In other parts of the country the policy pursued is to place the dairy societies in touch with Industrial Co-operative Societies which have dairy departments.

The Adaptability of Co-operation.—It will be seen from what has been said that the principles of co-operation can be readily adapted to meet the conditions which pertain to the dairying industry in various parts of the country.

Further particulars on this point may be obtained on application to the Agricultural Organisation Society, Queen Anne's Chambers, Tothill Street, Westminster, S.W.

The Blackburn Co-operative Bank, Limited.

The Blackburn Co-operative Bank, Limited, which is affiliated to the Urban Co-operative Banks Association, was registered in 1902 under the Industrial and Provident Societies Act, with the object of carrying on the business of banking on co-operative principles for the benefit of its members. Membership is confined to persons resident in or connected with Blackburn; each member must be approved by the committee,

and is required to pay an entrance fee of *6d.*, and to take at least one share in the Society, to be paid for in instalments of *6d.* per week per share, or within a shorter time. The shares are of the value of £1, and are not withdrawable, but are transferable, with the consent of the committee, to any person who shall be or become a member of the Society. The liability of each member is limited to the amount of the shares for which he has made himself responsible.

The Society has power to receive deposits or loans at interest from members or other persons, on terms to be arranged by the committee with the lenders. Loans may be made to members only on such security, in the shape of sureties, or in some other suitable and convenient form, as may appear sufficient to protect the Society against loss.

Out of the profits of each year, 20 per cent. must be carried to the reserve fund, and out of the remaining profits a dividend not exceeding 5 per cent. on fully paid-up shares may be declared, the remaining profits being at the disposal of the general meeting. The reserve fund is the property of the Society, and cannot be divided among its members; it can, however, be made available, by resolution of the general meeting, to cover deficiencies which may arise from unforeseen losses.

The affairs of the Society are conducted by a Committee of Management, consisting of sixteen members, all of whom at the present time are artisans. During the last six years the number of shareholders has increased from 257 to 409, almost the whole of whom belong to the artisan class; the share capital paid up has risen from £421 to £562; the number of deposits from 42 to 60; and the amount on deposit at the end of the year, from £160 to £287, or an average of £4 15*s.* per deposit. The rate of interest paid on deposits is $2\frac{1}{2}$ per cent. The number of loans granted during the year has increased from 195 to 282, and the amount lent from £1,076 to £1,160, or an average of £4 per loan. The rate of interest charged on loans is $10\frac{5}{6}$ per cent., or *2d.* per pound per month of four weeks. Borrowers are also charged a loan fee of *3d.* per £ on the amount borrowed, with a maximum fee of 5*s.*

For last year the income was as follows:—

	£	s	d	£	s	d
Interest	61	1	10			
Entrance and Loan Fees	13	11	6			
Fines	2	7	2			
Sale of Rules, Cards, &c	1	3	0			
Total Income ...				78	3	6

and the expenditure:—

	£	s	d	£	s	d
Rates, Rent, &c. . .	15	11	5			
Postages, Printing, &c	8	2	0			
Sundry Expenses . .	9	14	5			
				33	7	10
Leaving a profit on the working of the year of .				£44	15	8

In accordance with the rules, 20 per cent. of this amount, that is, £9, was carried to the reserve fund; £10 was allotted to the payment of the secretary's salary; £2 2*s.* to the payment of the auditors; £2 10*s.* to depreciation of office furniture, thus clearing this item off the books; £20 was voted as a dividend at $3\frac{1}{2}$ per cent. on all fully paid-

up shares, and the remaining £1 3*s.* 8*d.* was carried to the contingency fund.

During each of the last six years the working of the Society has shown a profit, varying from £24 to £53, which is at the disposal of the general meeting, subject to the rule that 20 per cent. must be carried to the reserve fund. Under this provision, during the six years £51 have been added to that fund. In each year the meeting has voted £10 as salary to the secretary, and £2 2*s.* in payment of the audit fee. In four of the six years, a dividend was voted on fully paid-up shares, in two years the rate having been 2½ per cent., and in the last two years 3¾ per cent. In each year a sum has been added to the contingency fund, amounting altogether to £36 14*s.* for the six years. This fund is utilised chiefly to meet bad debts and other unforeseen expenditure. During the last six years the amount written off as bad debts was £23 1*s.* 11*d.*, but of this £17 8*s.* was recovered, and the contingency fund now shows a credit of £45 19*s.* 3*d.*, as against £17*s.* 11*s.* 2*d.* five years ago. During the same period the reserve fund has increased from £38 10*s.* to £89 10*s.*

The balance-sheet for 1912 shows the following condition of affairs :—

	£	s	d	£	s	d
Cash in Bank	324	17	5			
Loans due from Members plus interest	705	1	5			
Other Assets	2	10	0			
Total Assets				1,032	8	10

Against this the liabilities were :—

	£	s	d	£	s	d
Due to Depositors, plus interest	287	6	2			
Other Liabilities	12	17	5			
Total due to Others than Shareholders				300	3	7
Balance owned by the Society and its Shareholders				732	5	3
Voted by General Meeting as Dividend, Salaries, &c.				34	12	0
Due to Shareholders for Paid-up Share Capital				562	4	0
Balance—Net Assets				£135	9	3

This sum represents the savings of the Society on its working up to date, and has been allocated as follows :—

	£	s.	d.
Reserve Fund	89	10	0
Contingency Fund	45	19	3

All money received is sent weekly to a bank, which allows 2¾ per cent. interest on the balance at credit. Personal sureties are required when the sum borrowed by a member exceeds £4; for loans of from £1 to £4, the borrower's wife has to sign along with her husband a joint and several promissory note. Few borrowers fail to repay their loans in the stipulated time, and none of the amount out on loan at the end of 1912 is considered likely to turn out a bad debt.

During the last few years there has been a decrease in the number of members from 479 to 409, and in the amount of loans from £1,525 to £1,160, due to the weeding out of undesirable members, to greater

care exercised by the committee in considering applications for loans, and to the prosperous condition of the cotton trade. The bank is evidently well managed, and the steady increase in its reserve and contingency funds is satisfactory. If this accumulation of net assets continues, and if the shareholders will content themselves, as hitherto, with a moderate dividend, the bank should soon be able, in accordance with true co-operative principles, to reduce the somewhat high rates of interest and loan fees charged to borrowing members. Meanwhile, it has not only provided its members generally with a place of deposit for their savings at 2¾ per cent. interest, under their own control, but has furnished its poorer members with small loans for such purposes as the meeting of expenses connected with births, sickness, and funerals, the payment of rates and insurance premiums, and the cost of repairs to property. By loans obtained from the Society, one member was enabled to send his wife to a convalescent home, another to start poultry farming, another to buy a horse, and another to stock a small nursery. In such ways this Co-operative Bank must have been of great use to many of its members, who could not have borrowed the small sums they required from any other source, except on ruinous terms.

The Hand-in-Hand Pig Club, Spalding.

There are in Spalding and its neighbourhood a number of pig insurance clubs, among which one of the most successful is the unregistered Hand-in-Hand Club, which was founded in 1888, mainly at the instance of a local auctioneer, who acts as treasurer to the club. The number of members increased in the ten years ending with 1911 from thirty-four to forty-eight; they are mainly working men, who insure one or two pigs each. Some of them keep two pigs, one to be eaten by themselves and their families, and one to be sold to help to pay the rent. The number of pigs insured has increased in the ten years from forty-four to seventy-two, an average of 1·5 pigs per member.

For the ten years the number of pigs insured amounted to a total of 641, and the number on which claims were paid by the club was fifty-two, an average death-rate of 8·1 per cent. per annum. In the best year the death-rate was only 1·9 per cent. per annum; and in the last year, which was the worst of the ten, it rose to 16·6 per cent., a very high rate. When a new member insures a pig, and the pig dies within eight weeks, the club pays 3*s.* 6*d.* in the £ on its value; if it dies after eight weeks the club pays half its value; and if it dies after three months it pays three-fourths of its value. But an old member, who has been paying regular insurance contributions, is paid three-fourths of the value of the pig without regard to the time during which that particular pig has been insured, so that in most cases the club is liable for three-fourths of the value of any pig that may die owing to disease or accident. Until two years ago the compensation payable was 17*s.* 6*d.* in the £, but, owing to the diminution of the funds, the maximum sum payable has since been reduced to 15*s.* in the £ on the value of the pig at the time it falls ill.

The total amount paid on claims during the ten years was £122 9*s.*, but, on the other hand, the club received altogether £8 3*s.* from the

sale of carcasses, so that the net loss to the club was £114 6s. This gives an average loss per pig that died of £2 4s., and an average loss per pig insured of 3s. 7d. The largest amount paid on any pig was £6 10s., paid on the death of a breeding-sow. The rate usually adopted for the valuation of a pig is 6s. per stone of 14 lb.

Each member pays an entrance fee of 1s. per pig, and an insurance contribution of 1d. per week for each pig, paid in advance monthly, so that the insurance contribution comes to 4s. 4d. per pig per annum. As a matter of fact, the income from this source in the ten years was £136 14s., an average of 4s. 3d. per pig insured, and in itself was more than sufficient to cover the net loss to the club from payment of insurance claims.

Besides the premium income, the club received £1 8s. from interest and £8 3s. from the sale of carcasses, and its total income for the ten years was £147 9s. On the expenditure side the chief item, besides the £122 9s. paid on claims, was £27 5s. paid from the funds of the club for the annual supper, which gives an average spent on the supper of 1s. 3d. per member and of 10d. per pig insured. The other expenses of the society are not large, the main item being the salary of £1 5s. paid to the wheelwright who acts as secretary.

The society is managed by a committee of thirteen, who are almost all working men, the chairman being a Dutch foreman: their work is done for the club without remuneration. The marker, whose business it is to accept pigs for insurance after satisfying himself that they are sound and free from disease, receives 2d from the owner for every pig that he marks, and if he has to go more than two miles to mark a pig, he is paid 4d. by the club. The total expenditure of the club during the ten years has been £163 18s., which exceeds the total income for that period by £16 9s, and the amount of the insurance fund has therefore fallen from £40 at the beginning of the period to £25 last year. It rose to £55 in 1904, but has since fallen by £30

The affairs of the club are, on the whole, in a sound condition, and, except in the matter of the annual supper, are economically managed; but there are some respects in which, according to the experience of other pig clubs in England, its system of working might be improved to the advantage of the members. In the first place, it is not usual, at all events among pig clubs registered under the Friendly Societies Act, for the cost of the supper to be charged to the funds of the club, and if the £27 5s. which the club has spent on this object during the last ten years had been defrayed by the members out of their own pockets, the club would now have had £52 to its credit instead of £25, and would have shown a profit of £12 on the working of the ten years, instead of a loss of £15. Looked at in another way, if the cost of the supper were not charged to the club, the members might reduce the premium they pay on each pig from 4s. 4d. a year to 3s. 6d. a year, without reducing the present position of their insurance fund. Another matter in which the income of the club might have been slightly improved is that of interest: the average amount of the Insurance Fund at the end of the year has been £42, and if £30 of this had been kept in the Savings Bank, the interest on it at 2½ per cent. would have come to £7 10s., instead of £1 8s. actually received.

But by far the most important matter into which the club should look is the very high death-rate, which averaged 8·1 per cent. per annum for the last ten years, whereas the average death-rate for the registered pig clubs in England for 1911 was only 4·8 per cent., and several of the pig clubs have, by good management, been able to keep down their average death-rate for a number of years to something like 1 per cent. per annum. Even to judge from the experience of the Hand-in-Hand Club itself, there is reason for examination into the cause of the recent excessive mortality, for the death-rate has doubled during the last five years as compared with the previous five years. During the first five years it was 5·5 per cent., which in itself is a high rate, and during the last five years it averaged 10·3 per cent.; for the year 1911 it reached the alarming figure of 16·6 per cent. Possibly the comparatively high death-rate may be partly due to too much in-breeding and to the flatness of the district, which is said locally to render the pigs unusually liable to disease, but it seems probable that closer supervision, especially in the methods of accepting pigs for insurance and of the treatment by owners of their sick pigs, would enable the society to lower its average death-rate to its own earlier record of 5·5 per cent., and therefore to reduce its insurance contribution rate from 4*s.* 4*d.* per annum to something much nearer 2*s.*, which other clubs find sufficient as an average charge on store pigs.

Mutual Trading between Agricultural and Industrial Co-operative Societies.

In a speech by Mr. E. J. Cheney at the ninth International Co-operative Congress, reported in this *Journal* for September, 1913, p 524, it was mentioned that the Agricultural Organisation Society had carried out a certain amount of propagandist work in this country with the object of promoting mutual trading between agricultural and industrial co-operative societies, and an account of the present state of this side of the co-operative movement, given in the recently issued Annual Report of the Agricultural Organisation Society for the nine months ending March 31st, 1913, may be of interest.

The Agricultural Organisation Society has appointed two organisers, whose special work it is to encourage a closer relationship between societies affiliated to the Agricultural Organisation Society and industrial co-operative societies.

Conferences are held periodically for the purpose of ascertaining :—

(1) The position of the agricultural co-operative societies and how far they are in a position to supply the requirements of the industrial co-operative movement.

(2) The requirements of the industrial movement, and what organisation is necessary on the part of agricultural societies to meet those requirements.

(3) How far and by what means it may be practical to bring about harmonious and satisfactory relationships between these two important branches of the co-operative movement.

From the discussions at the conferences held during the year it

is clear that there is a strong disposition on the part of the industrial co-operative movement to meet sympathetically and practically the wishes of the agricultural societies, or, in other words, it is prepared to give preference to agricultural co-operative societies provided that the conditions of delivery, quality, and price do not compare unfavourably with those prevailing in the open market.

It appears that the purchases of the agricultural movement from industrial co-operative sources are about three times as large as the purchases in the other direction. It is pointed out that the branch in which the greatest developments may be expected is the sale of milk and dairy products to the industrial movement. The value of milk, cheese, and butter sold to industrial co-operative societies during 1912 by dairy societies affiliated to the Agricultural Organisation Society was £16,467. The value of eggs sold to industrial co-operative societies in 1912 was £4,007. The Eastern Counties Farmers' Co-operative Association have sold pigs to the value of £14,583 to various industrial co-operative societies. The Sutcombe farmers sold rabbits to the value of £52 to an industrial society in 1912. The value of fruit, &c., sold by societies affiliated to the Agricultural Organisation Society to the industrial movement during the year was £4,133.

Several industrial co-operative societies who farm their own land in the area covered by the Midland Farmers' Co-operative Association (Nottingham) have become members of the latter society, for the purpose of trading for their agricultural requirements. Each society takes up shares, according to the acreage of the farms they hold. The amount of business done by the Midland Farmers' Co-operative Association and the industrial societies in membership during the year amounted to £3,880.

The Organisation of the Wool Industry.

The foreign and Colonial wool industry is so organised that the wool is eventually placed on the London market in large consignments, carefully graded and packed, so that the woollen manufacturers can, with a minimum amount of trouble, buy just the quality and amount which they require for a particular kind of cloth or other woollen article. It is different with home-grown wool. British wool is either not separated into classes at all or the separation is done only in the roughest way; it is often carelessly packed in bulky sheets and contains all sorts of dirt and impurities, and is sold through local brokers or agents or at the local auction fairs. The difference in method is not unnaturally reflected in the prices received for the wool in the different cases.

There seems no reason why British farmers should not, by combination, place themselves in an equally strong position as, and secure the same advantages in the marketing of their wool which are now obtained by, Colonial sheep growers. To this end the Agricultural Organisation Society has put forward a definite scheme* by which the wool producers of a district might co-operate with this object. There

* *Agricultural Organisation Society.* Report for the nine months ending March 31st, 1913.

are two alternatives in this scheme; under the first, there would be a special local society, formed on co-operative lines, to deal with its members' wool; the second provides for the wool being dealt with by a special department of an existing trading or other agricultural society of a co-operative nature. It is in either case necessary to secure the use of a building which will serve as a central depôt in the district, to which farmers of the district, being within carting distance, can bring their wool, and there have it classified by an expert, bulked with other wool of the same standard of quality, similarly treated, and marketed in the most saleable form. The shearing itself will be done at the farm, and it is suggested that the most economical course is for the first rough separation to be made there at the time of shearing before the wool is taken to the depôt, but it will be necessary that each member shall bind himself to conform to the regulations of the society as regards shearing, the preliminary treatment of the fleeces, packing, delivering to depôt, and treatment of sheets. In addition, each member will be required to conform to the decisions of the society with regard to the classification of the wool at the depôt and its marketing.

The first instance of home-grown wool being dealt with on co-operative lines occurred last year, when about fifty members of the North-West Flintshire Agricultural Co-operative Society disposed of their wool through the Society, the total value being about £400. The wool was collected at the Society's warehouse, and there classed, with the result that an increase of 1*d.* per lb. was obtained over the current prices obtained by other farmers locally.

As a result of the propagandist work of the Agricultural Organisation Society, sheep farmers in two districts, namely, Carnarvonshire and the Brandsby and Malton district in Yorkshire, decided to deal with their clips of this year on the lines advocated.

In the Brandsby and Malton district the work was undertaken by the Brandsby Agricultural Trading Society. Some 7,000 fleeces were dealt with and dispatched to London for sale at the July Wool Sales. The competition for the wool was keen, and satisfactory prices were realised. It is the intention of the sheep farmers of the district to repeat the experiment next year.

In Carnarvonshire a special wool society was formed under the title of the Carnarvonshire Wool Society. The number of fleeces dealt with amounted to 10,000. The wool was shipped to London and sold at the September Wool Sales. Satisfaction was expressed at the result of the sale, and it is anticipated that a considerable extension of the movement will take place next year in Carnarvonshire and the adjoining counties.

A difficulty in the way of this branch of agricultural co-operation is that farmers have been accustomed to borrowing money, on the security of their wool, from the local agents and wool buyers, and they expect similar facilities as to credit from a co-operative society.

OFFICIAL NOTICES AND CIRCULARS.

Copyright of Ordnance Survey Maps.

By Section 18 (provisions as to Government publications) of the Copyright Act, 1911 (1 and 2 Geo. 5, c. 46), the position of the copyright in Ordnance Survey maps has been placed upon a definite footing. As an outcome of the Act, regulations (official number, O.S. 23) governing the reproduction or utilisation of Ordnance Maps by map-making firms and others, were published by the Controller of H.M. Stationery Office on January 1st, 1913, and these fully explain the circumstances in which such reproduction or utilisation may be allowed.

Recently a case was brought to the notice of the Controller where a firm had photo-mechanically reproduced the 4-mile Ordnance Survey map, and placed copies of the reproduction on sale to the public at 3*d*. each. Proceedings were instituted under Section 11 of the Act of 1911 against the firm for selling the infringing copies, and they were ordered to pay a fine of 40*s*. and £15 15*s*. costs, and to give up or destroy the remaining copies and the plates of the map.

Map-making firms or others who contemplate utilising the Ordnance Survey maps in the preparation of other maps are advised to study the regulations (a copy of which can be obtained from the Director General, Ordnance Survey Office, Southampton), before actually commencing work.

Introduction of Potatoes from Ayrshire into England and Wales.

The Board of Agriculture and Fisheries desire to inform all potato growers and dealers that in consequence of an outbreak of wart disease of potatoes in North Ayrshire, they have passed an Order prohibiting the introduction of potatoes from that district into England and Wales. All persons who have already received seed potatoes from that district should carefully examine the tubers, and if any sign of disease is apparent, the Board should be informed. Dealers and growers are reminded that it is illegal to plant or sell for planting any potatoes attacked by this disease under a penalty of ten pounds.

Appointment of Live Stock Inspectors.

The President of the Board of Agriculture and Fisheries has appointed as Inspectors under the Board's Live Stock Scheme, Mr F. N. Webb, P.A.S.I., of Babraham, Cambridge, and Mr C T. A. Robertson, of Burningfold, Dunsfold, Godalming.

Mr. Webb has been agent on the Babraham Estate for the last twenty-three years, and has been instrumental in bringing Mr. Adeane's flocks and herds to that high degree of excellence which has made them famous both at home and abroad. In addition to being a most successful and practical breeder and exhibitor of live stock, Mr Webb has judged at all the principal agricultural shows (including the Royal, Dublin, Smithfield, and the Dairy Show) He was also one of the judges of British breeds of cattle at the International Exhibition at Paris in 1900. Mr. Webb is one of the founders of the Dairy Shorthorn Association, of which he has been the secretary since its formation.

Mr. Robertson obtained first-class honours in Agriculture at Edinburgh University, and is a life member by examination of the Highland and Agricultural Society. He has farmed extensively in Suffolk and Surrey, he has been a very successful breeder and exhibitor of stock, and he has also judged at various important shows, including the Royal, Highland, and Smithfield.

Regulations for the Show of Thoroughbred Stallions, 1914.

The show of thoroughbred stallions suitable for getting half-bred horses will be held by the Board at the Royal Agricultural Hall, Islington, in conjunction with the Hunters' Improvement and National Light Horse Breeding Society, on March 10th, 11th, and 12th, 1914.

No stallion is eligible for exhibition unless and until it is registered by the Board for the registration year 1913–14. Application for the registration of stallions to be entered for the show should be made not later than January 1st, 1914.

King's Champion Challenge Cup.—His Majesty the King has been graciously pleased to offer for competition a Cup for the Champion Stallion in the Show to which a King's Premium is awarded, to be selected from amongst the stallions recommended for Super-Premiums. The cup will be held by the winner for one year only, and shall then be returned to the Board of Agriculture and Fisheries. A Gold Medal will also be awarded by the Board of Agriculture and Fisheries to the owner of the Champion Stallion.

King's Premiums.—Fifty King's Premiums are offered by the Board of Agriculture and Fisheries for award to thoroughbred stallions, not under four or over twenty years old, to travel prescribed districts in England and Wales.

The average value of a Premium is £197 12*s.* 6*d*, paid by the Board, as follows:—

	£	s	d
Premium of 100 guineas—half paid at the time of award and the other half after the close of the service season ...	105	0	0
Service fee of £1 1s a mare (average number, 65), paid after the close of the service season .	68	5	0
Foal fee of 12s 6d a foal (average number, 39), paid after the close of the foaling season .	24	7	6
	197	12	6
In addition, a service fee of £2 a mare (average number, 65) is chargeable to the owner . ..	130	0	0
Average earnings	327	12	6

Fees are paid by the Board in respect of (but not exceeding) 90 mares, and the earnings of a stallion serving that number would be approximately £410.

Super-Premiums.—Super-Premiums of the value of 100 guineas, paid at the time of award, will, in addition to the ordinary Premium, be given to selected stallions of exceptional merit. Not more than 12 will be awarded in 1914.

The owner of a stallion is required to state on the entry form whether he enters his stallion for competition for a Super-Premium.

If he does so enter it, he is to sign an undertaking agreeing that the stallion shall be exhibited (if awarded a Super-Premium in 1914) at the Show of Premium Stallions in 1915 in a class for which it is eligible in accordance with the Regulations of the Board.

If the stallion is not so exhibited the owner is to forfeit and pay to the Board the value of the Super-Premium, *i.e.*, One Hundred Guineas.

Copies of the regulations, conditions of awards, entry, and service, entry forms, and forms of application for the registration of stallions, may be obtained from the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, S.W. Letters so addressed need not be stamped.

MISCELLANEOUS NOTES.

Importation Regulations.

Importation of Animal Products into the Netherlands.—A Ministerial Decree, dated September 15/19, 1913, makes the following provisions, to take effect from January 1st, 1914, as to the importation of animal products into the Netherlands.—

Importation will be permitted of fresh hides, fresh and salted meat, unmelted fat, unmanufactured wool and hair, feet, horns, and other refuse of horned cattle, sheep, and goats; and of fresh and salted meat, unmelted fat, feet, and other refuse of swine, and further of meat of solidungulates. With each consignment there must be produced a written statement respecting the nature and quantity of the goods, the places of origin and destination, and the purpose for which the goods will be used. The goods must be properly packed, so that the contents of the packages are completely hidden and there is no risk of their being lost, and the contents must be plainly specified on the outside of the packages.

Importation of Plants by Post and of Orchids into the United States.—The Board of Agriculture and Fisheries desire to bring to the notice of all nurserymen and exporters of plants that the importation of plants by post has been prohibited by the Government of the United States of America.

The Board are also informed that the Horticultural Board of the Department of Agriculture, Washington, has ruled that orchids are included in the definition of nursery stock, and cannot therefore be imported without a certificate of freedom from disease.

Importation of Live Stock into Canada.—The Board of Agriculture and Fisheries have been officially informed that on account of the outbreak of foot-and-mouth disease in this country the Canadian Government have ceased to issue permits for the importation into Canada of cattle, sheep, and other ruminants, and swine.

Importation of Horses, Mules, and Asses into Jersey.—The Board have received a copy of the regulations governing the importation of horses, asses, and mules into Jersey, which are to supersede the regulations of March 14th, 1912. The regulations provide that animals must enter the island through the ports of St. Hélier or Mont Orgueil, written authority stating the conditions under which they may be landed having

been previously obtained from the Committee of Harbours and Roads. The animals must be accompanied by the certificate of a veterinary surgeon to the effect that they were free from contagious disease at the time of their embarkation. They will be examined by the Government Veterinary Surgeon on arrival. In the absence of authority from the Committee, a written permit must be obtained from the Master of the Port of St. Hélier or the Harbour Master at Mont Orgueil, and on landing the animals must be sent direct to a place of quarantine approved by the Committee where, unless they show clinical symptoms of glanders, they will be submitted to the mallein test within ten days, and if found free from contagious disease their admission to the island will be sanctioned by the Government Veterinary Surgeon. Diseased animals may, at the discretion of the Committee, be destroyed.

Importation of Animals and Fodder into Jersey.—The Board have been notified that in consequence of the existence of foot-and-mouth disease in Great Britain, the importation of animals and fodder into Jersey from this country is temporarily prohibited.

Importation of Live Stock into the Argentine Republic.—A Decree issued on November 15th closes the ports of the Argentine Republic to cattle, goats, sheep, and swine imported from England. Scotland and Ireland are not included in this prohibition.

Importation of Animals into the East Africa Protectorate.—The Board have been informed by the Colonial Office that the restrictions placed by the Proclamation of August 28th, 1912,* on the importation of cattle, sheep, and pigs into the East Africa Protectorate were removed on August 29th last.

The Board wish to draw attention to the new rules regulating the importation of live stock into the Protectorate, dated July 10th, 1913, amending the Diseases of Animals Rules, 1911.

The regulations as amended provide that animals may only be imported into the Protectorate through the following (among other) places: Mombasa, Kis-Mayu, Malindi, Vanga, and Lamu.

If the Inspecting Officer is not satisfied that an imported animal is free from disease, and that it has been kept free from risk of infection, he may order it to be kept in quarantine or to be slaughtered.

All cattle, sheep, and goats imported by sea must be accompanied by a certificate from a qualified veterinary surgeon that such animals were drawn from an area free from disease, were examined by him, and were free from disease at the date of examination, such certificate to bear a date not earlier than ten days before the date of embarkation.

Every head of cattle imported shall be accompanied by a certificate from a qualified veterinary surgeon that such animal has passed the tuberculin test; but although an animal may be accompanied by the necessary certificate, it may, at the discretion of the Inspecting Officer, be again subjected to the tuberculin test, and in the event of such animal reacting to the test it may be slaughtered. Where a post-mortem examination fails to demonstrate the existence of tubercular lesions, the importer will be entitled to compensation.

The Inspecting Officer may cause any imported animal to be disinfected before its removal from the place of examination or retention.

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* See *Journal*, November, 1912, p. 696.

All sheep and goats will, unless the Chief Veterinary Officer otherwise directs, be dipped.

Every horse, mule, or donkey imported into the Protectorate must be accompanied by a certificate from a veterinary surgeon that such animal has passed the mallein test.

All swine imported must be accompanied by a certificate of health from a veterinary surgeon.

Importation of Hides, &c., into the United States.—A recent Circular (T.D. 33,501) of the United States Treasury Department amends the existing regulations governing the disinfection of hides of neat cattle, horns, bones, &c., imported in the United States.

These regulations can be inspected at the office of the Board, 4, Whitehall Place, London, S W.

Notes on Agriculture Abroad.

The First Year's Working of a Milk Control Society in Hungary.—The milk control society of Sopron, Oedenburg, Hungary, was founded on November 1st, 1911. The results of its first year's working, viz., up to November 1st, 1912, are discussed in the *Wiener Landwirtschaftliche Zeitung*, June 25th, 1913. The members are seven large dairy farmers with 548 cows. The average milk yield per cow during the year was 6,705 lb., with an average fat content of 3 63 per cent., so that the total amount of fat per cow was 243 lb. This yield compares very favourably with the results of long-established societies in Austria, Germany, and Hungary. The average milk yield per cow per milking day was 21 lb. The milk yield at the end of the first year's working was nearly 17 per cent. higher than at the beginning. An account is being kept of the feeding of the cows in order to correlate this with the milk yield. The Danish system of "food-units" is being employed for the purpose.

The Control of Manures, Feeding-Stuffs, and Seeds in Switzerland through the medium of Experimental Stations.—A scheme has been adopted in Switzerland by which the trade in manures, feeding-stuffs, and seeds is controlled by arrangement between firms supplying these articles, farmers purchasing the goods, and the experiment stations acting under the Ministry of Agriculture. The scheme is set forth in a decree of the Swiss Ministry of Agriculture of June 9th, 1913, and published in the *Landwirtschaftliche Jahrbuch der Schweiz*, Heft. 5, 1913. A brief summary of the very detailed provisions of the decree may be given here.

The scheme is worked by the firms entering into contracts with the central management of the experiment stations, under which the former bind themselves to give certain guarantees (these are specified in great detail) with their goods, the firm's customers having *ipso facto* the right to free analyses of their purchases by the experiment stations, and the "control" firms being bound by these analyses and being compelled to compensate the purchasers where the goods do not come up to guarantee. These contracts can be made at any time, and must remain in force for at least one year (reckoned from the 1st January in the year following the date at which the contract was entered into). Six months' notice must be given by firms wishing to dissolve the contract.

The control firms, in addition to giving guarantees, bind themselves to state the composition and, when desired, the origin of the goods; and no statements are allowed which are intended to deceive the purchaser. A contract firm must not produce or trade in any secret (*i.e.*, patent) material.

For the benefit of agriculturists the central management of the experiment stations publishes a yearly list of the control firms and the goods sold by them. These firms must send at least five samples of their goods for analysis during the year, under penalty of being removed from the list, which penalty is also imposed if they persist, after warning, in trading in articles of low value, or are guilty of fraudulent practices.

With every consignment of goods to their customers the control firms must forward a voucher entitling the purchaser to free analysis. The purchase of any one kind of goods must, however, be of either 500 kg. in weight or 50 fr. in value in the case of manures and feeding-stuffs, or of 5 kg. in weight in the case of seeds generally (but 1 kg. of vegetable seeds and 25 kg. of cereal seeds). Elaborate instructions are issued by the central management of the experiment stations with a view to securing the selection of average samples for analysis, and there are precautions for ensuring that the samples are from the goods of control firms only.

The cost of these free analyses is defrayed by a control tax paid by the control firms to the central management of the experiment stations. In the case of Swiss firms the tax is 1 fr. 50 for every 10,000 kg. of manures with one manurial ingredient, and 2 fr. 50 for every 10,000 kg. of mixed manures and feeding-stuffs delivered to customers. The tax is higher in the case of foreign firms, and there are reductions in the tax with increasing sales. The tax in the case of seeds also varies with the annual out-turn of the firm. *The whole of the firm's goods must be placed under control.*

Although the scheme is purely optional on firms supplying manures, feeding-stuffs, and seeds, it is probable that all such firms will eventually be driven to place themselves under control.

French Government Machine-Testing Station.—By a decree of August 7th the French Government authorised the cession to the State of a building in which will be installed the station for testing agricultural machinery. The cost of the building, and the expenses of installation, have been charged to the 1913 Budget. The station will form a permanent exhibition of French agricultural machinery, all machinery of foreign construction being excluded. It will be open to the public free on certain days, and the expenses of upkeep are to be met by the imposition of a tax on the sites or on the machinery exhibited. From time to time the Department of Agriculture will organise temporary exhibitions of the more modern and useful machinery.

Live Stock in Argentina.—The Board have received, through the Foreign Office, a report from H.M. Minister at Buenos Aires (Sir R. Tower) on the cattle show at that town in 1913.

Sir R. Tower states that the animals exhibited show the evolution which has taken place during the last decade in the herds and flocks of Argentina. Until a few years ago a certain number of fine specimens were exhibited at these annual shows, but the animals generally were

lacking in uniformity of type, and had, in addition, many other faults. The exhibits in 1913, however, demonstrated the efficacy of the work done to improve the stock of the Republic, and the ability of the native farms to produce animals equal to, if not surpassing, those imported from abroad.

Some hundreds of animals are annually imported into Argentina, and it is estimated that the average dead-weight of cattle has been increased by about 260 lb. per head as a result of this policy.

Shorthorns and Herefords are most in favour in the Argentine, Aberdeen Angus ranking third in the public estimation. The record price of £7,000 was realised at the show in 1913 for the champion shorthorn local-bred bull, while the "reserved" champion realised £3,900, and the "first prize, third class," £3,700. The highest prices which have been paid for bulls at the shows from 1903–1912 have been as follows:—

	Shorthorns	Herefords
	£	£
1903	960	260
1904	1,800	260
1905	3,500	500
1906	1,900	600
1907 ...	1,750	400
1908	3,000	480
1909	3,000	400
1910	1,300	720
1911	2,100	600
1912	2,700	2,000

Sir R. Tower remarks that the prices now paid for home-bred stock are significant of the comparatively recent change of ideas as to the efficacy of breeding from native-born stock. Some few years ago it was considered that degeneration rapidly took place unless there was a constant flow of new European blood among the herds, but it has now been proved that the process of degeneration is slow among cattle, although rapid in sheep. The prices also tend to exemplify the fact that Argentine breeders are willing to pay almost any amount to obtain the best blood possible to improve their stock.

As regards the prices of horses, six two-year-old Missel Thrush colts fetched an average of £800 at the show, one being sold for £1,746.

Paris Agricultural Show.—According to a recent notice in the *Journal Officiel,* an agricultural show will be held in the Grand Palais des Champs-Elysées, Paris, from February 16th to 23rd, 1914. The exhibits will include fat and store cattle, sheep and pigs, as well as poultry; agricultural, horticultural, and dairy products will be represented, and attention will be given to matters relating to agricultural co-operation. An exhibition of agricultural machinery and implements will be held from February 16th to 25th in conjunction with the show. Programmes of the show may be obtained on application to the Ministère de l'Agriculture, 78, rue de Varennes, Paris.

Budget of the Belgian Ministry of Agriculture for 1913.—The Belgian Budget for 1913 provides for an expenditure on agriculture of £505,920, of which £502,260 is classed as ordinary expenditure and £3,660 as extraordinary expenditure. The ordinary expenditure may be classified under the following general headings (*Moniteur Belge,* September 10th, 1913):—

	£
Salaries and expenses of staff at central office and pensions . .	41,850
Salaries and expenses of State agronomists in connection with agricultural inspection	8,270
Compensation and other expenses in connection with the slaughter of diseased animals and the prevention of disease	122,000
Salaries and expenses of the veterinary service	8,360
Subsidies to agricultural committees, associations and exhibitions, and agricultural co-operative credit societies; publication of the *Bulletin de l'Agriculture*	13,760
Veterinary education—upkeep of the State veterinary school . .	10,380
Agricultural education—upkeep of the State agricultural institute Grants to agricultural schools	23,380
Experimental and research work Expenditure of State agricultural station and State botanical garden . .	26,400
Expenses of Higher Horticultural Council Subsidies to horticultural associations . . .	5,140
Horticultural education. Expenses of State horticultural schools. Grants for horticultural education	8,360
Forestry and fishery expenses . .	51,930
Roads, waterways, tramways and carriage of goods	182,180
Unforseen expenses	250

Agricultural Progress in Egypt.—H.M. Consul for the district of Alexandria states in his report for 1912 that a commission has been formed in Egypt to encourage horse breeding, and several English stallions have been imported by the Khedivial Agricultural Society. English poultry has been imported for breeding purposes with most satisfactory results, and practical instruction in poultry farming is being given at the School of Agriculture and provincial farm schools. Efforts are being made by the Department of Agriculture to prevent the introduction of plant diseases, and all imported plants, seeds, &c., will now be thoroughly fumigated before delivery. (*F.O. Reports, Annual Series,* 5097.)

Produce of Potato and Root Crops in 1913.

The following preliminary statement shows the estimated total produce and yield per acre of the potato and root crops in England and Wales in the year 1913, with comparisons for 1912, and the average yield per acre of the ten years 1903–12.—

	Crops	Estimated Total Produce		Acreage		Average Estimated Yield Per Acre		Average of the ten years 1903–1912
		1913	1912	1913	1912	1913	1912	
		Tons.	Tons	Acres.	Acres.	Tons	Tons	Tons
England and Wales	Potatoes .	2,894,655	2,211,039	442,035	462,903	6·55	4·84	5·98
	Turnips and Swedes ...	12,794,323	12,887,761	1,048,843	1,072,943	12·20	12·01	13·15
	Mangolds	7,611,123	8,787,345	419,456	485,664	18·15	18·09	19·45
England	Potatoes .	2,754,487	2,115,033	416,697	436,948	6·61	4·84	6·03
	Turnips and Swedes	11,936,443	12,084,970	992,380	1,015,958	12·03	11·90	13·03
	Mangolds ..	7,434,471	8,572,407	409,150	473,250	18·17	18·11	19·49
Wales	Potatoes ..	140,168	126,006	25,338	25,955	5·53	4·85	5·14
	Turnips and Swedes ...	857,880	802,791	56,463	56,985	15·19	14·09	15·26
	Mangolds .	176,652	214,938	10,306	12,414	17·14	17·31	17·77

NOTE.—The yield of potatoes in England and Wales, 6·55 tons per acre, is just about the same as in 1910 and 1911, and rather more than half a ton above the decennial average: it is practically 1¾ tons more than last year. The total production amounts to 2,894,655 tons, which is some 650,000 tons more than in 1912. Turnips and swedes have yielded 12·2 tons per acre, or about one-fifth of a ton above last year; but still nearly a ton under average; owing to the reduced acreage, however, the total, 12¾ million tons, is just below the production of 1912. Mangolds, with 18·15 tons per acre, are also a little better than in 1912, but 1·3 tons below the average. In their case also the acreage has been reduced, and the total production is 7,611,123 tons.

The Weather in England during November.

District	Temperature.		Rainfall			Bright Sunshine.	
	Daily Mean	Diff from Average.	Amount	Diff from Average	Number of Days with Rain	Daily Mean	Diff. from Average
	°F	°F	Inches	Inches		Hours	Hours.
Week ending Nov 8th							
England, N.E	45·2	+0·6	0·33	−0·25	4	2·7	+0·7
England, E ...	46·8	+1·7	0·21	−0·29	5	3·3	+0·8
Midland Counties	45·5	+1·2	0·33	−0·30	5	3·2	+1·3
England, S.E	48·8	+1·9	0·58	−0·19	5	3·6	+1·3
England, N.W ..	46·6	+0·9	0·68	−0·19	6	2·3	+0·5
England, S W.	48·5	+1·1	1·01	−0·07	6	3·0	+0·8
English Channel	52·1	+1·3	1·30	+0·31	5	3·2	+0·5
Week ending Nov 15th:							
England, N.E	46·0	+2·8	0·87	+0·31	6	2·2	+0·4
England, E. ...	48·2	+4·8	1·35	+0·85	7	2·7	+0·6
Midland Counties ..	46·3	+3·6	1·34	+0·79	7	2·4	+0·7
England, S E .	49·2	+4·0	1·56	+0·90	6	2·6	+0·6
England, N.W.	47·3	+3·1	1·41	+0·61	7	2·1	+0·5
England, S.W	49·3	+3·3	2·01	+1·07	7	2·7	+0·6
English Channel	52·3	+2·7	1·66	+0·77	7	2·6	+0·1
Week ending Nov. 22nd							
England, N.E.	47·2	+5·2	0·40	−0·13	4	2·3	+0·5
England, E	48·3	+6·5	0·41	−0·06	3	2·3	+0·6
Midland Counties	48·1	+6·7	0·43	−0·07	4	1·3	−0·3
England, S.E	49·1	+5·5	0·76	+0·17	4	2·0	+0·2
England, N W. ...	48·3	+5·3	1·27	+0·48	6	1·3	−0·2
England, S W	49·0	+4·4	1·08	+0·20	5	1·3	−0·6
English Channel .	51·6	+3·3	0·70	−0·09	4	2·1	−0·1
Week ending Nov. 29th:							
England, N.E.	45·5	+4·4	0·20	−0·29	4	2·2	+0·7
England, E.	45·3	+4·6	0·02	−0·48	2	2·9	+1·3
Midland Counties	44·4	+4·0	0·07	−0·46	2	1·8	+0·4
England, S.E....	46·3	+3·9	0·05	−0·59	2	2·2	+0·6
England, N.W. .	47·6	+5·3	0·30	−0·56	5	1·5	+0·2
England, S.W. .	46·7	+3·0	0·36	−0·64	4	1·2	−0·6
English Channel .	49·7	+2·4	0·29	−0·61	5	0·7	−1·3

Produce of Corn, Pulse and Hay Crops in 1913.

The following preliminary statement shows the estimated total produce and yield per acre of the corn, pulse, and hay crops in England and Wales in the year 1913, with comparisons for 1912, and the average yield per acre of the ten years 1903–1912:—

	Crops	Estimated Total Produce 1913.	Estimated Total Produce 1912.	Acreage 1913.	Acreage 1912.	Average Estimated Yield per acre 1913.	Average Estimated Yield per acre 1912.	Average of the Ten Years 1903–1912.
		Quarters	Quarters	Acres	Acres	Bshls	Bshls	Bushels
ENGLAND AND WALES	Wheat	6,641,487	6,680 347	1,701,588	1,863,314	31 22	28 68	31 31
	Barley	6,321,472	5,542,405	1,558,851	1,456,522	32 44	30 44	32 87
	Oats	9,375,523	9,145,690	1,974,700	2,072,479	37 98	35 30	40·61
	Beans	914 834	928,541	258,582	271,109	28 30	27 40	29 78
	Peas	421,736	487,380	127,785	173,064	26 40	22 53	26 68
		Tons	Tons			Cwts	Cwts	Cwts
	Seeds Hay *	2,709,068	2,031,052	1,700,481	1,554,909	31 86	26 12	28 98
	Meadow Hay †	6,343 254	6,034,432	5,069,692	4,941 534	25 02	24 67	23 59
		Quarters	Quarters			Bshls	Bshls	Bushels
ENGLAND	Wheat	6,511,168	6,544,234	1,663,453	1,821,931	31 31	28 74	31 42
	Barley	5,983,594	5,198,356	1,469,776	1,365,038	32 57	30 47	32 99
	Oats	8,520,513	8,292,549	1,772,247	1,865,569	38 50	35 56	41 23
	Beans	910 935	925,062	257,191	269,088	28 30	27 41	29 80
	Peas	420 512	485 608	127,367	172,441	26 41	22 53	26 70
		Tons	Tons			Cwts	Cwts	Cwts
	Seeds Hay	2,472,158	1,804,895	1,533,005	1,378,985	32 25	26 18	29 45
	Meadow Hay	5,704,936	5,530,564	4,504,078	4,394,906	25 33	25 17	24 06
		Quarters	Quarters			Bshls	Bshls	Bushels
WALES	Wheat	130,319	136,113	38,135	41,383	27 34	26 31	27 00
	Barley	337,878	344,049	89,075	91,484	30 35	30 09	30 69
	Oats	846 010	853,141	202 453	206,910	33 43	32 09	34 91
	Beans	3,899	3,479	1,091	1,121	28 59	24 83	27 05
	Peas	1,224	1,772	418	623	23 42	22 75	22 46
		Tons	Tons			Cwts	Cwts	Cwts
	Seeds Hay	236,910	226,157	167,476	175,924	28 29	25 71	24 94
	Meadow Hay	638,318	563,868	565,614	546,628	22 57	20 63	19 81

* Hay from Clover, Sainfoin, and Grasses under rotation
† Hay from Permanent Grass

NOTE.—The yield per acre this year of all the seven crops included in these returns is above that of 1912, and in the case of both kinds of hay it is also above the average of the past ten years

The total production of wheat, upon a reduced acreage, amounts to 6,641,487 quarters, which is very slightly below last year; and the average yield—31 22 bushels per acre—while 2½ bushels better than in 1912, is only just below the ten years' average. Barley has yielded almost 32½ bushels per acre, exactly 2 bushels more than last year, but about ½ bushel below the mean; and the total production is quite three-fourths of a million bushels above 1912. Oats are relatively the poorest crop of the season, the 37·98 bushels per acre being 2⅝ bushels below the average, but still 2⅝ bushels more than in 1912; the total production is also more than last year. Beans are about 1½ bushels and peas about ¼ bushel, below the mean, but well above 1912; but their total production, owing to the decreased area sown with these crops, is less than in the previous year. The hay crop is satisfactory; that from clovers and rotation grasses being almost 5¾ cwt. above 1912, and

nearly 3 cwt. over the average, and meadow hay being 1⅓ cwt. above average; these figures representing the heaviest yield since 1907. The total production of hay of both kinds amounts to 9,052,322 tons, or 927,000 tons more than last year.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for November, 1913, issued by the International Institute of Agriculture, shows the production of the cereal crops this year. The countries for which it is possible to give an approximate estimate of the production are as follows:—In *Europe:* Prussia, Belgium, Denmark, Spain, France, Great Britain and Ireland, Hungary, Italy, Luxemburg, Netherlands, Rumania, Russia in Europe (63 governments), Switzerland; in *America:* Canada, United States; in *Asia:* India, Japan, Russia in Asia (10 governments); in *Africa:* Algeria (excluding the Department of Algiers), Tunis.

Wheat.—The estimated production in the above-mentioned countries amounts to 429,457,000 qr., as compared with 393,283,000 qr. in 1912, the increase being equal to 9·2 per cent. The area under production showed an increase on 1912 of 1·4 per cent.

Rye.—The total production in the specified countries (excluding Great Britain and Ireland, India, Japan, Algeria, and Tunis) is estimated at 187,570,000 qr., which is slightly more than in 1912, when the production amounted to 187,214,000 qr. The area planted was greater by 1·7 per cent.

Barley.—The production in all the countries (except India) is placed at 163,510,000 qr., against 152,117,000 qr last year, or an increase of 7·5 per cent. The area under production exceeded that of 1912 by 4·6 per cent.

Oats.—The estimated production in the above countries (with the exception of India) totals 425,176,000 qr., against 421,883,000 qr. last year, the increase amounting to 0·8 per cent., while the area planted was greater by 2·7 per cent.

Maize.—The total production in the countries named above (excluding Prussia, Belgium, Denmark, France, Great Britain and Ireland, Luxemburg, Netherlands, India, and Algeria), with the addition of Egypt, is estimated at 356,349,000 qr., as compared with 431,290,000 qr. in 1912, the decrease being equal to 17·4 per cent. The area under production was slightly larger than last year.

Sugar Beet.—The estimated production in Prussia, Hungary, Belgium, Denmark, Spain, Italy, Netherlands, Rumania, Switzerland, and Canada is placed at 25,128,000 tons, which shows a decrease of 1·2 per cent. as compared with last year, when the production amounted to 25,442,000 tons.

France.—The production of potatoes this year is officially estimated at 12,985,000 tons, compared with 15,025,000 tons last year. The condition of winter wheat on December 1st was estimated at 74 (73 in 1912), of winter rye at 74 (74 in 1912), of winter barley at 77 (74 in 1912), and of winter oats at 76 (74 in 1912). (*Dornbusch*, December 8th.)

Germany.—The production of the principal crops is officially esti-

mated as follows (1912 figures in brackets):—Winter wheat, 18,885,000 qr. (17,945,000); spring wheat, 2,493,000 qr. (2,077,000); winter rye, 55,381,000 qr. (52,632,000); spring rye, 740,000 qr. (623,000); spring barley, 20,240,000 qr. (19,186,000); oats, 68,620,000 qr. (60,187,000); potatoes, 53,251,000 tons (49,403,000); clover hay, 11,003,000 tons (7,821,000); and meadow hay, 28,716,000 tons (27,237,000). The proportion of potatoes diseased is estimated at 4·2 per cent., compared with 4·1 per cent last year. (*Deutscher Reichsanzeiger.*)

Denmark.—According to the preliminary official report on the harvest of 1913, wheat, barley and oats were good as regards both quantity and quality. Rye was under average in quantity, but the quality was good. The yield of potatoes was large, and the tubers were of considerably better quality than usual. A good average crop of sugar beet was obtained, while the hay crop was above average in quantity, the quality being particularly good. (H.M. Consul at Copenhagen, November 24th.)

Canada.—A bulletin issued by the Census and Statistics Office at Ottawa gives the following provisional estimates of the yields of fodder crops:—Potatoes, 76,720,000 bushels; turnips and other roots, 73,090,000 bushels; hay and clover, 10,050,000 tons, fodder corn, 2,436,300 tons; lucerne, 251,700 tons; and sugar beet, 161,000 tons. The area estimated to be sown with winter wheat for the 1914 crop amounts to 1,006,700 acres, as compared with 1,086,800 acres at the same date last year. The condition of winter wheat for all Canada averages 94 per cent. The percentage of winter ploughing completed compares favourably with last year, when, however, the conditions were not at all good.

Argentina.—The second supplement to the *Bulletin of Agricultural Statistics* for November gives the following revised estimates of the areas sown with cereals:—Wheat, 16,235,000 acres, a decrease of 5 per cent. compared with the area sown at the same date in 1912; rye, 227,000 acres, an increase of 130·6 per cent.; barley, 417,000 acres, an increase of 56·6 per cent.; and oats, 3,085,000 acres, an increase of 4·7 per cent.

Live Stock in Spain.—The number of horses in 1912 was 525,853, as compared with 546,035 in 1911, or a decrease of 3·7 per cent. Cattle totalled 2,561,894, against 2,541,112, an increase of 0·8 per cent.; sheep, 15,829,954, against 15,725,882, an increase of 0·7 per cent.; and pigs, 2,571,359, against 2,472,416, an increase of 4·0 per cent. (*Bulletin of Agricultural Statistics,* November, 1913.)

Agricultural Conditions in England and Wales on December 1st.

The Crop Reporters of the Board, in reporting on the crops and the agricultural conditions in England and Wales on December 1st, state that the mild and generally open weather of November enabled good progress to be made with autumn cultivation and sowing of the winter corn, except in Wales and the north-west, where there was too much rain, and work was much hindered. Work is consequently more advanced than at this date a year ago; the area already under wheat

being from 5 to 10 per cent. greater than on December 1st, 1912, while it is estimated that nearly four-fifths of the area intended for this crop has already been sown. Where showing above ground the young corn is everywhere looking well.

Mangolds had practically all been lifted by the end of November, and clamped in good condition. The roots are in most districts rather small, but healthy. The total production of mangolds in England and Wales is estimated at 7,611,123 tons, on an area of 419,456 acres, or 18·15 tons per acre, this yield being very slightly better than in 1912.

Turnips and swedes generally continued to make growth during November. These roots also are somewhat small, and generally sound, though there are occasional complaints as to their keeping quality in a few districts. The total production this year is 12,794,323 tons, or 12·20 tons per acre, as compared with 12·01 tons in 1912.

The total production of potatoes in England and Wales is returned as 2,894,655 tons, about 650,000 tons more than in 1912, the yield this year being 6·55 tons per acre.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on December 1st, 1913, certain diseases of animals existed in the countries specified :—

Austria (on November 12th).
Anthrax, Blackleg, Foot-and-Mouth Disease (total of 1,477 Höfe infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period November 1st—15th).
Anthrax, Blackleg, Foot-and-Mouth Disease (144 outbreaks in 81 communes), Rabies.

Bulgaria (for the period November 8th—16th).
Glanders, Sheep-pox, Sheep-scab.

Denmark (month of October).
Anthrax, Foot-and-Mouth Disease (2 outbreaks), Swine Erysipelas, Swine Fever.

France (for the period November 16th—22nd).
Anthrax, Blackleg, Foot-and-Mouth Disease (1,429 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period November 1st—15th).
Foot-and-Mouth Disease (291 infected places in 43 parishes), Glanders and Farcy, Swine Fever.

Holland (month of October).
Anthrax, Foot-and-Mouth Disease (one outbreak), Foot-rot, Swine Erysipelas.

Hungary (on November 12th).
Anthrax, Dourine, Foot-and-Mouth Disease (total of 2,235 "cours" infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period November 10th—16th).
Anthrax, Blackleg, Foot-and-Mouth Disease (2,172 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period June 1st—August 15th).
Anthrax, Glanders and Farcy.
Norway (month of October).
Anthrax, Blackleg.
Rumania (for the period November 5th—13th).
Anthrax, Foot-and-Mouth Disease (6,695 animals), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.
Russia (month of July).
Anthrax, Foot-and-Mouth Disease (24,143 animals in 303 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.
Servia (no further returns received).
Spain (month of September).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (752 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.
Sweden (month of October).
Anthrax, Blackleg, Swine Erysipelas.
Switzerland (for the period November 17th—23rd).
Anthrax, Blackleg, Foot-and-Mouth Disease (1,381 "étables," entailing 16,515 animals, of which 230 "étables" were declared infected during the period), Swine Fever.

Agricultural Labour in England and Wales during November.

The supply of agricultural labour in England and Wales during November was, according to statements in the Monthly Agricultural Report (December 1st), not too plentiful as a general rule, although reports from different districts varied very much. On the whole labour was probably rather more scarce in the north than in the south.

Northern Counties.—In some localities, more particularly in *Durham,* the supply of extra labour for lifting roots was not quite sufficient. Otherwise the supply was equal to the present low demand. In *Cumberland* and *Westmorland* difficulty was experienced in getting men at Martinmas, and wages were not lowered, as had been expected. In east and south *Lancashire* there was a deficiency, but in other parts labour was fairly plentiful. In *Cheshire* the supply was moderate. The supply was generally equal to the demand in the East and North Ridings of *Yorkshire,* but in the Cleveland district and many parts of the West Riding, labour was difficult to obtain.

Midland Counties.—On the whole there was, perhaps, sufficient labour; but there was some scarcity in all parts of Stafford, and complaint was made of the scarcity of expert labourers in north-west *Derby* and south *Leicester,* especially of milkers in the latter district.

Eastern Counties.—In most districts the supply was sufficient for the time of year. Labour was scarce for root lifting in south *Cambridge,* in south-west and a part of east *Norfolk,* and on the black lands in west *Norfolk.* There was a deficiency of labour, generally, in west Holland, and in east Holland female labour for potato picking was scarce, many women earning 2*s.* 6*d.* to 3*s.* per day.

South-Western Counties.—The supply was generally sufficient in

most districts, and even plentiful in parts of *Dorset* and *Wiltshire*. In south-west *Cornwall* and *Devon* a scarcity, particularly of skilled labourers, horsemen, and ploughmen was reported.

South-Eastern Counties.—The supply was sufficient, and in a few instances plentiful, but in north-east *Kent*, young labourers, and in east *Sussex*, efficient men, are scarce.

Wales.—There was a sufficient supply of labour generally, but there was a shortage in some parts of *Flint, Denbigh, Monmouth, Glamorgan, Carmarthen,* and *Pembroke*.

THE CORN MARKETS IN NOVEMBER.

C. KAINS-JACKSON.

British Wheat.—Supplies at Mark Lane were smaller than in October, and business was therefore reduced. Demand was fair, and little of the grain sent to London, mainly from East Anglia, remained unsold when November closed. During part of the month prices were decidedly low at Mark Lane, and both Kentish and Essex markets outbid the metropolis. Value, however, had improved by the 25th, and prices in the last week were firm. The country markets showed a slow trade for more than half the month, but sales slightly increased in the last week. The range of prices on the 29th may be given about as follows.—Chicken, 448 lb., 28*s.*; common red, 30*s.* to 36*s.* per 504 lb.; white, 33*s.* to 37*s.* per 504 lb.; Revitts, 30*s.* to 32*s.* per 480 lb. The inquiry at some markets was better for white than red wheat.

Colonial and Indian Wheat.—Canada did not press wheat on sale very long after the end of October, and by November 10th the market was rallying. It closed on the 29th nearly 2*s.* above the lowest level of depression for the chief Canadian kinds. The top-price of Dominion corn, 37*s.*, is, however, below that of any recent year, and millers have acquired considerable stocks since Michaelmas. They have latterly turned to Australian for its good colour, and have also been fairly free purchasers of Indian white. Values at the close of the month were about 37*s.* for Australian and fine Indian white, but as the latter weighed 492 lb., against 480 lb. in the case of Australian, it was in reality the cheaper.

Foreign Wheat.—The United States continued to ship red winter freely, but the recovery in Canadian allowed of 2*d.* per cental improvement in the price, the month closing at 7*s.* 2*d.* Russian wheat was in increased request after about the 17th, but there continues to be difficulty with respect to the state in which shipment can be guaranteed and to comparative freedom from impurities. The crop report of the Central Statistical Committee at St. Petersburg was published on the 24th, and the total of 122,156,000 qr. disclosed considerably surprised the trade. Value receded at all markets, and the range of prices at the close of the month was from 33*s.* to 35*s.* per 492 lb. Several cargoes were sold at 34*s.* for prompt shipment from Black Sea ports, and at 34*s.* 6*d.* to 34*s.* 9*d.* from Baltic ports. Argentine wheat during the

month was a slow spot trade, but several cargoes for January shipment were placed at 34*s.* 3*d.* to 35*s.*, the latter being the closing price.

Wheat Supplies and Shipments.—Imports were not in excess of an average for the time of year, which is usually one of free supply in anticipation of reduced arrivals in January and February. The quantity on passage at the end of the month was little over 1½ million quarters, and was therefore nearly a million below the average. The month's shipments were nearly 2½ million quarters from North America, 2,241,000 qr. from Russia, and 747,000 qr. from S.E. Europe, but against these totals, which rather surpassed expectation, the shipments from India (231,000 qr.), Australia (206,000 qr.), and La Plata (136,000 qr.), were all on the moderate side, and hence the world shipments of the month did not reach any extraordinary total.

Flour.—Owing to the slow and poor trade in October, which continued during the early days of November, London millers reduced prices from the 12th by 6*d.*, accepting 26*s.* for Town Households, and corresponding prices for sorts above and below that standard type, with the result that improved business was done. On the 26th the sixpence was again added, and the month closed with 26*s.* 6*d.* for Town Households. Country millers complained of small sales at lowish prices, 23*s.* to 26*s.* per sack for the most part. There was a quiet trade all through the month in American winter wheat flour at 24*s.* 6*d.* to 27*s.* 6*d.* per sack. Manitoba flour was rather pressed on sale and constituted the chief menace to the product of the home mills. Many sorts were obtainable, prices ranging from 24*s.* to 27*s.*, but the main pressure was exerted by the medium qualities which at 25*s.* to 25*s.* 6*d.* compared very closely with home makes at 26*s.* 6*d.* North America in November shipped 700,000 sacks, and the month closed with 228,000 sacks on passage. The by-products of the mill remained on sale at low prices; fine middlings at £7, and coarse at £6, were of no little advantage to the stock and poultry fattening interests.

Barley.—There have been many complaints of the depressed state of the market for 448-lb. barley, and it appears to be a fact that business has not been so bad since 1910. Buyers are stated to have "disappeared," and farmers having apparently a full crop so far as bulk goes, have delivered the grain with a freedom which caused a market already weak to become disastrous. Averages like 24*s.* at Banbury, 25*s.* 6*d.* at Bristol, 25*s.* 2*d.* at Berwick, and 24*s.* 9*d.* at Kingsbridge, have disturbed the trade in the midlands, west, north, and south-west, while 26*s.* 4*d.* at Norwich, 26*s.* 5*d.* at Lynn, and 27*s.* 3*d.* at Bury St. Edmunds, are none too encouraging returns from the famous barley districts of East Anglia. London closed with really good malting barley offered at 34s., while sound brewing grain, lacking in nothing but the ideal fine ale colour, was pressed on sale at 30*s.* At most of the country markets there was a good deal of robust but stained and somewhat irregularly ripened grain on offer at 27*s.* to 28*s.* for poultry use. Foreign malting barley has not been much in evidence; about 36*s.*. has been made by Californian. While 448-lb. barley has been depressed, there has been a decided rally in 400-lb. kinds, the feeding demand freshening up in a rather striking manner, and the month closing with Persian at 20*s.* 6*d.* to 21*s.*, Russian at 21*s.* to 21*s.* 6*d.*, and Indian at 26*s.* 6*d.* to 27*s.* per qr. Shipments of the month were 2,883,000 qr.

from Russia, 510,000 qr. from Europe S.E., 153,000 qr. from America's two seaboards, and 105,000 qr. from India and Persia. The Russian shipments were large, and there was a larger exportation than usual of Moldavian. On the 29th there were on passage 545,000 qr., which is a good deal less than at the same time last year.

Oats.—The month in London closed with a rather good average for English, and some fine heavy oats have been on sale at the midland and western markets. On the other hand, such averages as 16*s.* 3*d.* at Bedford, and 16*s.* 9*d.* at Dorchester, at markets in the middle of the month, showed the presence of a good deal of seriously damaged grain. The average price of Clipped Gartons in London on the 28th, the last London market of the month, was about a guinea per 336 lb., with ordinary good 336-lb. oats at a sovereign, and light, or 304-lb. sorts at 17*s.* to 17*s.* 6*d.* The trade in imported oats for prompt delivery ex warehouse has been small, with 17*s.* to 17*s.* 6*d.* for 304 lb., a fairly steady quotation both for Argentine and for Russian. The speculative business in Argentine new crop for January and February shipment has been in marked contrast with the spot dullness. Shipments for the month were 70,000 qr. from North America, and 489,000 qr. from Russia. There were only 135,000 qr. on passage at the end of the month.

Maize.—The Argentine shipments were 1,539,000 qr., and the Russian 82,000 qr.; America was not a shipper, and the exports of Burma were insignificant. Imports for the first three months of the cereal year, however, September 1st–November 30th, were very heavy, and at the rate of over 15½ million quarters for the twelvemonth. The market is now said by some to need a million quarters monthly, but this total is a good deal in excess of what used to be assumed. The price of maize hardened as the month went on, despite the large stores known to exist. The very small crop in America is now accepted as an undoubted fact by the entire trade, and confirmation of the most practical kind may be found in America's refusal to ship it. At the end of the month cargoes on passage from Argentina were obtainable at 24*s.*, and from Russia at 25*s.* cost, freight, and insurance, while at Chicago 23*s.* 6*d.* was the price of the new crop to ordinary home buyers. As it would cost about 4*s.* 6*d.* to get the maize to London, trade in maize with America cannot occur without a revolutionary change in prices on one side or the other. At the end of the month there were 900,000 qr. of maize on passage, against 1,610,000 qr. a year ago.

Oilseeds.—The cheapness of linseed has remained as a boon to those with stock to fatten. Prices are about 55*s.* for English (424 lb.), 53*s.* for Dutch (424 lb.), 50*s.* for Russian (416 lb.), 46*s.* for Indian (410 lb.), and 44*s.* for Argentine (416 lb.). The last-named is the sort in which most business has been done. There are 124,000 qr. on passage, and the month's shipments were 311,000 qr. from La Plata, 158,000 qr. from India, 15,000 qr. from Russia, and 42,000 qr. from the United States. Cottonseed has kept at 9*s.* to 9*s.* 6*d.* per cwt. for Egyptian. For Indian and Brazilian 7*s.* is mentioned, but the superior cleanliness of the Egyptian product makes it so much the safer food that it has the better sale at the higher price.

Various.—Beet sugar has remained well under ten shillings per cwt. Rice has been rather cheap, while rice bran has fallen to a price which

is tempting to buyers. Canaryseed still stands at the fancy price induced by the Balkan war. A decline of 1*s.* to 2*s.* per qr. on the month is recorded in haricot beans and in hempseed. Beans, peas, tares, and dari have sold very steadily, but rye has been almost entirely neglected, and is now cheaper than it has been for some years.

THE LIVE AND DEAD MEAT TRADE IN NOVEMBER.

A. T. MATTHEWS.

Fat Cattle.—The supplies of fat cattle in English markets continued moderate during November. In the week ending November 19th the returns showed a deficiency of 850 compared with the corresponding week in the three previous years, and one of 54,799 on the present year's supplies up to that date. While good grazing conditions have helped to maintain the general quality of the stock on offer from the pastures, there is a very marked difference between the value of these and the stall-fed animals, which are now beginning to appear at market. The difference suggests that the latter are paying well for the extra cost of feeding.

Average prices have been very steady, as will be shown by the following figures —Shorthorns in about thirty English and Welsh markets averaged 8*s.* 9*d.* and 7*s.* 11*d.* per 14-lb. stone for first and second quality, against 8*s.* 9*d.* and 8*s.* in October; Herefords, 8*s.* 11*d.* and 8*s.* 4*d.*, against 8*s.* 11*d.* and 8*s.* 2*d.*; Devons, 8*s.* 11*d.* and 8*s.* 1*d*, against 9*s.* 3*d.* and 8*s.* 2*d.*; Welsh Runts, 8*s.* 8*d.* and 8*s.*, against 8*s.* 5*d.* and 8*s.*; and Polled Scots, 9*s.* and 8*s.* 6*d.*, against 9*s.* and 8*s.* 9*d.* per stone. One of the features of the month was the fact that much higher prices were realised in London for Herefords and Devons than those ruling in country markets, even markets situated in the home districts of the breeds. The explanation no doubt is that the best animals have been selected for the London market

Another and more unsatisfactory feature has been the large number of two-year-old heifers which have appeared at Islington, instead of being retained for breeding purposes.

Veal Calves.—Calves for rearing have been in good request, and hence supplies for the butcher have been restricted. Prices have consequently risen during the month, and averages were 9¼*d.* and 8¼*d.* for first and second quality respectively, or about ½*d.* per lb. higher than last year at this season.

Fat Sheep.—The deficiency in the sheep supplies is very marked. In the week ending November 19th the supply was 4,727 below the three-year average, and 192,413 short for the year up to that date. It is possible (and this is the most hopeful side of the situation) that many more shearling ewes are being kept for breeding, thus increasing the shortage at market. There has certainly been an excellent demand for store sheep during the autumn.

The trade has been exceedingly firm during the month, and a very general advance of about ¼*d.* per lb. has been established. Downs averaged 9¾*d.*, 8¾*d.*, and 7¼*d.* per lb. for the three qualities, against

9¼*d.*, 8½*d.*, and 6¾*d.* in October; Longwools, 9½*d.*, 8½*d.*, and 6¾*d.*, against 8¾*d.*, 7¾*d.*, and 6¼*d.*; prime Cheviots, 10*d.*, against 9½*d.*; and prime Cross-breds, 9¾*d.*, against 9¼*d.*, per lb. These prices are about 1*d.* per lb. above those ruling a year ago, but values have not yet quite touched the exceptionally high level of April, 1912, when for one week the average for Downs in all markets was 10½*d.* per lb. It is generally believed, however, that they will do so during the coming winter. Some very exceptional prices have been made for Longwools at Hull, where sheep of this class have made 11*d.* per lb. for first, and 9½*d.* for second quality.

Fat Pigs.—The trade for bacon pigs has been firm on the whole, but as the more general season for killing has commenced, supplies have naturally been larger. The averages were 8*s.* 4*d.* and 7*s.* 10*d.* per 14-lb. stone, against 8*s.* 6*d.* and 8*s.* in October. Prices have varied widely at different centres, and in the last week they were quoted as high as 9*s.* 2*d.* at Chichester, while at Penzance the highest price was 7*s.* 4*d.* per stone.

Carcass Beef—British.—Trade for beef in the dead-meat market has been quietly steady without special feature. Scotch has not met with quite so keen a demand as usual, and October prices were barely maintained. Short sides averaged 4*s.* 9*d.* and 4*s.* 7*d.*, against 4*s.* 10*d.* and 4*s.* 7*d.*, and long sides 4*s.* 5*d.* and 4*s.* 3*d.*, against 4*s.* 6*d* and 4*s.* 3*d.* per 8-lb. stone.

English sold relatively better, averaging 4*s.* 3*d.* and 4*s.* 1*d.*, against 4*s.* 2*d.* and 4*s.*, while Irish averaged 4*s.* 1*d.* and 3*s.* 11*d.*, against 4*s.* and 3*s.* 10*d* per stone.

Canadian Beef.—There were a few Canadian sides at the Central Market in the first week, which made 4*s.* 2*d.* and 4*s.* per stone, after which the supply ceased.

Chilled Beef.—Argentine chilled hindquarters started the month at 3*s.* 10*d.* and 3*s.* 8*d.* per stone, but have since stood at 3*s.* 6*d.* and 3*s.* 3*d.*, their average being 3*s.* 7*d.* and 3*s.* 4*d.*, against 3*s.* 8*d.* and 3*s.* 5*d.* in October. Forequarters have sold far better in proportion, there having been a sharp demand for the stewing portions. They have averaged 2*s.* 7*d.* and 2*s* 5*d.*, against 2*s.* 4*d.* and 2*s.* 2*d.* in October.

Frozen Beef.—As with chilled, the value of hindquarters has remained about stationary, averaging 3*s.* and 2*s* 8*d.* per stone, while forequarters have advanced from 2*s.* 3*d.* at the beginning to 2*s* 7*d.* at the end of the month.

Carcass Mutton—Fresh-Killed.—Although the demand for fresh-killed mutton in London has been rather lifeless, and prices low in proportion to those ruling in the live-stock markets, values have quietly advanced. Scotch averaged 5*s.* 5*d.* and 5*s.* 2*d.*, against 5*s.* 3*d.* and 4*s.* 11*d.* in October, and English 5*s.* 1*d.* and 4*s.* 9*d.*, against 4*s.* 9*d.* and 4*s.* 5*d.* per stone. Dutch has also realised about ½*d.* per lb. more, making 5*s.* 2*d.* for tegs and 4*s.* 6*d.* for wethers.

Frozen Mutton.—During the first three weeks New Zealand mutton averaged 3*s.* 3*d.* and 2*s.* 9*d.* per stone, or about ¼*d.* per lb. more than in the previous month, but in the last week there was none worth quoting. Australian and Argentine has also sold at enhanced prices, averaging 2*s.* 10*d.* and 2*s.* 6*d.*, and 3*s.* and 2*s.* 6*d.* respectively.

Frozen Lamb.—The supply of lamb from New Zealand has virtually ceased for the present, but new season carcasses from Australia and Argentina have been in fair supply, and are now making 3*s*. 4*d*. to 3*s*. 10*d*. per stone.

Veal.—There has been great scarcity of really good veal, but an abundance of undersized and underfed carcasses. The choicest Dutch has been easily worth 6*s*. per stone, and has occasionally made 6*s*. 4*d*., while much of the inferior has been sold at 4*s*. and under. The best English has touched 6*s*., but 5*s*. 8*d*. has been about the average top price.

Pork.—Supplies have been more ample, and though there has been no difficulty in clearing them, prices have weakened to some extent. Only in the first week was 5*s*. 4*d*. realised for the best small pigs, and in the last week quotations were 4*s*. 6*d*. to 4*s*. 10*d*. for English, and 4*s*. 2*d*. to 4*s*. 6*d*. for Dutch.

THE PROVISION TRADE IN NOVEMBER

HEDLEY STEVENS.

Bacon.—Contrary to the expectations of many, prices for most descriptions of bacon were higher after the beginning of the month, especially in the case of Danish and Dutch sides, which in some cases realised from 3*s*. to 4*s*. per cwt. above prices obtainable at the middle of November. Canadian and Russian sides participated in the advance, but not to the same extent, as arrivals from Russia have been more free. Canada continued to send small quantities, as dealers cannot compete successfully with the Continental curers; in cases where Canadian packers were mostly dependent upon the English markets for the sale of their cured product they have closed their packing houses, until pigs become more plentiful.

American bacon and hams show little change on the month. The consumptive demand has been small, but with moderate arrivals, and continued high prices in America, holders have not tried to force business by reducing prices. The arrivals of hogs at the curing centres have been more free, but have included a large percentage of immature animals, which in the ordinary course would have been retained by the breeders for several weeks longer. This slaughtering of young hogs is bound to cause a shortage in later months.

At Chicago during the month, prices for hogs have ranged from \$7.00 to \$8.25, against \$7.20 to \$8.20 last year, and \$5.40 to \$6.60 two years ago.

English pigs have remained firm on the whole, and it is thought by many that prices will rise still higher in the near future.

Cheese.—Prices showed little change in November, the demand being mostly of a hand-to-mouth character, buyers showing continued lack of confidence in the maintenance of prices.

Canadian advices estimate the November make as fully 50 per cent. under last year, while those who are in a position to judge estimate that on the closing of navigation of the St. Lawrence, the stocks in Montreal will not exceed 50,000 cheese, which would be the lowest in the last twenty years at close of navigation.

New Zealand cheese are now arriving in larger quantities, and are of a very satisfactory quality so early in the season, commanding prices within 1*s.* per cwt. of Canadians. On account of labour troubles in New Zealand shipping ports, the arrivals will be comparatively small in December, doubtless implying an increase in January arrivals and possibly a decline in prices early in the New Year.

Estimated stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 309,000, against 365,000 at the same time last year, and 314,000 two years ago.

Estimated stocks of New Zealand cheese in London were 5,700 crates (two cheese in each), against 8,000 last year, and 1,000 two years ago.

English cheese continues in good demand, in some markets realising 4*s.* to 7*s.* per cwt. above last year's November prices.

The mild weather has increased the make of factory cheese, for which there has been a fair demand.

Butter.—Throughout the month there has been a good demand for best butters, and the arrivals of new season's goods from Australia and New Zealand have found ready buyers at advancing prices, more especially for fancy New Zealands, this description by the end of the month realising as much as 130*s.* per cwt., compared with about 118*s.* last year at the same period.

Prices are expected to be still higher in December, owing to the ss. *Athenic* being delayed through strikes, and her shipment of 56,000 packages of butter not being due until early in the New Year. As it is expected that other heavy shipments will follow her, prices may be lower early in January.

The demand continues very poor for secondary goods, and prices favour buyers.

In Canada and the United States of America, prices are above an export basis, and no shipments to England can be expected from either country during this winter.

Shipments from New Zealand and Australia have already commenced to arrive in Vancouver, and find ready purchasers at full prices.

The following appears in the Montreal Trade Bulletin dated November 21st:—

"The reduction in the duty on butter entering the United States of 2½ c. per pound, has already affected the import trade of that country, inasmuch as it has opened a trade with Russia and the Argentine Republic. Last week amongst the imports into New York were reported 530 casks of Siberian, and 1,087 boxes of Australian creamery from London. But the most important factor was the report that large importations of New Zealand and Australian creamery for the United States are expected during the coming season, distributed *viâ* the Pacific coast."

Best Irish creameries are scarce, but large stocks of factory makes are reported to be held in English cold stores, and for these there is a very small demand; it is just possible that some of them may be shipped to New York, the new tariff making business possible.

Unit Prices of Artificial Manures. Statement of cost to the purchaser of 1 per cent. per ton of Nitrogen, Soluble and Insoluble Phosphates, and Potash derived from

	Bristol	Hull.	King's Lynn	Liverpool.
	s. d.	*s. d.*	*s. d*	*s. d.*
Nitrogen from :				
Sulphate of Ammonia 95% pure	14 2	13 6½	14 2	13 2
Calcium Cyanamide ...	11 10½	11 10	12 4	11 10
Nitrate of Soda pure 95%	15 5½	14 3	14 2½	14 7½
Nitrate of Soda pure 90%	—	—	—	13 6½
Nitrate of Lime ...	15 7	15 3	15 9	—
Soluble Phosphates from				
Superphosphate 35%	1 9½	1 8	1 6½	1 9½
" 33%	1 10	1 9	1 7½	1 9½
" 30%	1 10½	1 9	1 8	1 9½
" 26%	2 0	1 9½	1 9	1 11
Dissolved Bones . .	2 7	2 5	2 6	2 6
Allowed for Nitrogen	*18 6*	*17 4*	*17 3*	*18 3*
Allowed for Insol. Phos.	*1 11*	*2 0*	*1 6*	*1 11*
Insoluble Phosphates from :				
Basic Slag	1 7	1 7½	1 5	1 3
Bone Meal	1 5½	1 5	1 6½	1 6½
Allowed for Nitrogen	*14 3*	*13 9*	*14 8*	*14 7*
Steamed Bone Flour .	1 4½	1 4	1 6	—
Allowed for Nitrogen	*13 5*	*13 3*	*15 9*	—
Potash from :				
Kainit	4 5	3 10	3 11	4 3
Sulphate of Potash ...	4 10	4 3	4 4	4 6
Muriate of Potash... ...	4 3	3 6	3 8	3 8½
Potash Salts	—	3 3	—	—

NOTE.—These unit prices are based on the probable retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified. They are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the per-

various sources, at certain Ports and Manufacturing Centres, for December, 1913.

London.	Newcastle	Newport.	Plymouth	Silloth	Widnes
s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
13 11½	13 1½	14 4	14 2½	—	13 0
12 5	—	11 11	11 10	—	—
15 0	14 8	15 10	15 3	—	—
—	—	—	—	—	13 8
15 8	—	16 1	15 9	—	—
1 9	1 11	1 10	1 10	1 10½	1 8½
1 9	—	1 10½	1 10½	—	1 8½
1 10	1 11	1 10½	1 10½	1 11	1 8½
1 10	2 1	2 0	2 0	2 1	1 10
2 7	2 7	2 7	2 8	2 6	2 6
18 9	*17 6*	*18 7*	*18 10*	*17 7*	*18 4*
1 11	*1 10*	*2 0*	*2 0*	*1 10*	*1 11*
1 3	1 4	1 4½	1 7½	—	—
1 6	1 5½	1 6	1 7	—	1 6½
14 9	*13 10*	*13 7*	*15 7*	—	*14 10*
1 5	1 4	1 3	1 5	—	—
13 7	*13 2*	*13 2*	*13 10*	—	—
4 3	4 0	4 0½	4 0½	4 3	4 4½
4 8	—	—	4 10	—	4 6½
4 0	—	—	4 2	—	—
—	—	—	—	—	—

centages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and re-bagging the ingredients, bags, and loss of weight.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in November and October, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	November. First Quality.	November. Second Quality.	October. First Quality.	October. Second Quality.
FAT STOCK:—	per stone *	per stone *	per stone.*	per stone.*
Cattle:—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Polled Scots	9 0	8 6	9 0	8 9
Herefords	8 11	8 4	8 11	8 2
Shorthorns	8 9	7 11	8 9	8 0
Devons	8 11	8 1	9 3	8 2
Welsh Runts ...	8 8	8 0	8 5	8 0
	per lb.*	per lb *	per lb *	per lb.*
	d	*d.*	*d.*	*d*
Veal Calves	9¼	8¼	9	8
Sheep:—				
Downs	9¾	8¾	9¼	8½
Longwools	9½	8½	8¾	7¾
Cheviots	10	9¼	9½	8½
Blackfaced	9¾	8½	9	8
Welsh ...	9¼	8¼	8¾	7½
Cross-breds	9¾	8¾	9¼	8¼
	per stone *	per stone *	per stone *	per stone *
Pigs:—	*s. d.*	*s. d.*	*s d.*	*s d*
Bacon Pigs	8 4	7 10	8 6	8 0
Porkers ..	9 0	8 7	9 0	8 6
LEAN STOCK:—	per head	per head.	per head	per head
Milking Cows:—	*£ s.*	*£ s.*	*£ s*	*£ s*
Shorthorns—In Milk	24 3	20 9	24 10	20 8
,, —Calvers ..	23 9	20 1	22 19	19 0
Other Breeds—In Milk ..	20 11	17 12	21 13	17 11
,, —Calvers ..	—	15 10	16 15	14 5
Calves for Rearing	2 10	1 19	2 10	1 17
Store Cattle:—				
Shorthorns—Yearlings	11 10	9 19	10 16	9 6
,, —Two-year-olds	15 11	13 8	15 6	13 3
,, —Three-year-olds	19 2	16 14	18 17	16 3
Herefords —Two-year-olds	17 2	14 18	17 9	15 6
Devons— ,,	15 16	13 18	15 6	13 9
Welsh Runts— ,,	15 10	13 6	15 0	12 16
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Downs or Longwools ...	43 8	38 1	40 2	33 11
Store Pigs:—				
8 to 12 weeks old ...	25 7	19 4	26 9	20 10
12 to 16 weeks old ..	37 4	28 6	37 1	29 0

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in November, 1913.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description.	Quality.	Birmingham. s.	Birmingham. d.	Leeds. s.	Leeds. d.	Liverpool. s.	Liverpool. d.	London. s.	London. d.	Manchester. s.	Manchester. d.
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
BEEF:—											
English	1st	56	0	55	6	53	6	60	0	55	0
	2nd	53	0	53	0	50	6	57	6	50	0
Cow and Bull	1st	49	6	52	0	48	0	49	0	48	0
	2nd	42	6	46	6	42	6	44	6	42	0
Irish: Port killed	1st	52	6	53	0	53	0	57	0	—	
	2nd	49	0	49	6	50	0	54	6	—	
Argentine Frozen—											
Hind Quarters ...	1st	43	6	44	6	44	6	42	0	44	6
Fore ,, ...	1st	36	0	36	0	35	6	33	6	35	6
Argentine Chilled—											
Hind Quarters	1st	49	6	48	0	48	6	50	0	48	6
Fore ,, ...	1st	35	6	34	6	35	0	36	6	35	0
Australian Frozen—											
Hind Quarters	1st	42	0	41	0	39	6	42	0	40	0
Fore ,, ...	1st	35	6	35	0	34	6	33	6	34	6
VEAL:—											
British	1st	—		71	0	84	0	79	6	81	0
	2nd	70	0	66	6	74	6	70	0	74	6
Foreign ...	1st	—		—		—		86	6	—	
MUTTON:—											
Scotch	1st	—		—		79	6	76	0	78	6
	2nd	—		—		74	6	72	6	75	0
English	1st	73	0	78	6	77	6	71	0	75	0
	2nd	63	6	74	6	73	0	67	0	70	6
Irish: Port killed ..	1st	70	6	—		77	0	—		—	
	2nd	59	6	—		72	6	—		—	
Argentine Frozen	1st	40	6	41	0	39	6	41	6	39	6
Australian ,, ...	1st	37	6	37	6	36	0	39	6	35	6
New Zealand ,, ...	1st	—		—		—		46	0	—	
LAMB:—											
British	1st	—		—		—		—		—	
	2nd	—		—		—		—		—	
New Zealand	1st	56	0	53	6	48	6	52	6	49	0
Australian	1st	51	6	46	6	46	0	52	0	46	0
Argentine	1st	50	0	49	0	46	0	50	6	46	0
PORK:—											
British	1st	79	6	74	6	79	6	70	6	81	0
	2nd	73	0	72	6	74	6	66	0	76	6
Foreign	1st	—		—		—		65	6	—	

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913.

Weeks ended (*in* 1913).	WHEAT.			BARLEY.			OATS.		
	1911.	1912.	1913.	1911.	1912.	1913.	1911.	1912.	1913.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Jan. 4	30 5	33 2	30 5	23 11	33 3	28 6	17 0	20 7	19 10
,, 11 ...	30 8	33 1	30 3	23 10	33 0	28 4	17 2	20 8	19 2
,, 18 ..	30 11	33 4	30 5	24 4	33 3	28 6	17 4	20 11	19 4
,, 25 ...	30 11	33 7	30 11	24 5	33 1	28 10	17 3	21 1	19 4
Feb. 1 .	30 9	33 8	31 1	24 5	32 10	28 11	17 5	21 3	20 2
,, 8 .	30 5	34 0	31 0	24 6	33 2	28 10	17 5	21 4	20 1
,, 15 ...	30 3	34 4	30 9	24 7	32 10	29 1	17 6	21 7	20 2
,, 22 ...	30 2	34 6	30 11	24 9	32 8	28 8	17 7	21 9	20 7
Mar. 1 ...	30 0	34 1	31 0	25 0	32 0	28 6	17 5	21 6	20 4
,, 8 ...	30 1	34 1	31 3	25 0	31 7	28 5	17 5	21 8	20 0
,, 15	30 1	34 0	31 1	24 11	31 2	27 11	17 6	21 8	20 2
,, 22	30 2	34 1	31 1	25 0	31 10	28 6	17 5	21 9	19 11
,, 29 ..	30 3	34 4	31 3	24 11	30 3	27 6	17 5	21 8	19 7
Apl. 5	30 4	34 10	31 4	24 7	30 9	27 0	17 7	21 11	19 2
,, 12 .	30 3	35 4	31 3	25 2	30 2	27 8	18 3	22 1	19 2
,, 19	30 4	36 7	31 6	25 5	29 11	26 11	17 10	22 4	18 10
,, 26 ..	30 11	37 10	31 8	25 5	30 4	26 7	18 3	22 9	19 3
May 3 ..	31 4	38 1	32 2	25 7	30 2	25 11	18 6	23 1	19 6
,, 10 ..	31 8	37 11	32 6	25 1	31 1	25 9	19 0	23 7	19 6
,, 17	32 6	37 8	32 10	25 4	31 2	25 4	19 2	23 7	19 9
,, 24 ...	32 8	37 2	32 10	25 0	31 1	25 3	19 5	23 7	19 11
,, 31 ...	32 5	36 10	32 7	24 10	30 0	26 1	19 5	23 9	20 1
June 7 ...	32 4	36 11	32 10	25 7	29 11	26 2	19 7	24 0	19 8
,, 14 ...	32 3	37 0	32 8	23 11	30 8	24 7	19 8	23 10	20 2
,, 21 ...	31 11	37 5	32 8	23 9	30 8	23 10	19 10	24 0	19 8
,, 28 ...	31 10	37 10	32 8	24 5	30 2	24 3	19 9	23 11	19 1
July 5	32 1	38 2	33 1	25 10	31 7	25 2	19 9	23 11	21 0
,, 12 ..	32 3	38 3	33 4	25 10	30 2	25 10	19 11	24 1	19 4
,, 19 .	32 5	38 10	33 6	24 3	30 9	24 9	19 5	24 8	20 5
,, 26 .	32 5	38 9	33 10	23 8	30 9	24 1	19 7	23 4	20 8
Aug. 2 .	32 0	38 4	34 1	24 4	28 6	24 5	18 2	22 2	20 3
,, 9 ...	31 6	39 2	34 1	26 9	30 7	24 9	18 0	22 4	19 0
,, 16	31 6	38 2	34 3	27 8	28 3	24 7	17 10	21 8	18 7
,, 23 ..	31 8	35 6	33 7	28 10	28 1	26 5	18 0	20 10	18 8
,, 30 ...	31 7	34 10	32 7	28 4	28 6	29 0	18 3	20 8	17 10
Sept. 6 .	31 10	35 1	31 11	28 4	29 9	30 11	18 1	21 8	17 8
,, 13 .	32 0	33 5	31 9	29 0	29 0	31 5	18 5	20 5	18 0
,, 20 ..	32 4	32 7	31 7	29 11	29 6	30 9	18 9	19 10	17 11
,, 27 ..	32 6	31 7	31 6	30 5	29 9	30 1	19 1	19 5	17 9
Oct. 4 ..	32 7	31 8	31 3	30 9	29 7	29 9	19 5	19 8	17 10
,, 11 .	32 9	31 10	31 0	31 0	30 4	29 1	19 10	19 5	17 10
,, 18 ...	32 9	32 2	30 11	31 5	30 11	28 8	19 11	19 9	17 9
,, 25 .	33 1	33 1	30 7	31 7	31 6	28 7	20 6	19 10	18 0
Nov. 1 ...	33 4	33 4	30 1	31 10	31 10	28 2	20 8	20 1	17 9
,, 8 .	33 4	33 1	30 0	32 7	31 11	28 1	20 11	19 11	17 9
,, 15 ...	33 1	32 10	30 1	32 10	31 2	27 8	21 0	19 9	17 11
,, 22	33 0	32 1	30 4	33 5	30 11	27 5	20 10	19 11	18 1
,, 29 .	32 10	31 9	30 9	33 10	30 8	27 0	20 11	19 8	18 4
Dec. 6 ..	32 9	31 0	31 2	34 0	29 11	26 8	20 9	19 6	18 4
,, 13 ..	32 11	30 8		33 5	29 2		20 9	19 3	
,, 20 ...	32 9	30 7		33 5	28 11		20 8	19 1	
,, 27 ...	33 0	29 10		33 4	28 6		20 7	19 2	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of Wheat, Barley, and Oats per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

—		Wheat. 1912.	Wheat. 1913.	Barley. 1912.	Barley. 1913	Oats. 1912.	Oats. 1913.
		s. d.	s. d.	s. d.	s. d	s. d.	s. d.
France :	October	46 6	45 9	30 0	28 11	23 6	22 7
	November	47 1	45 2	30 5	28 7	24 1	22 4
Paris :	October	48 7	45 7	30 10	30 2	24 7	22 4
	November	49 1	45 8	31 5	29 9	24 9	21 10
Belgium :	September	35 7	32 10	30 0	26 4	25 7	20 9
	October	35 8	32 4	30 10	26 3	25 2	20 5
Berlin :	September	45 11	42 6	—	—	25 2	22 5
	October	45 4	39 9	—	—	26 0	21 11
Breslau :	September	39 10	41 9	31 10* 28 11†	27 8* 25 7†	27 3	21 9
	October	40 8	40 10	32 5* 28 10†	27 9* 25 7†	27 8	21 6

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of British Wheat, Barley, and Oats at certain Markets during the Month of November, 1912 and 1913.

—	Wheat. 1912.	Wheat. 1913.	Barley. 1912.	Barley. 1913.	Oats. 1912.	Oats. 1913.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London	34 6	31 1	31 8	28 4	21 11	19 7
Norwich ...	34 1	30 5	29 5	26 6	19 11	17 4
Peterborough	29 11	29 8	29 9	28 5	18 7	17 9
Lincoln...	30 9	30 0	31 10	28 6	20 2	18 5
Doncaster	30 11	29 6	31 4	27 1	19 11	18 3
Salisbury	33 0	28 8	32 2	27 10	20 4	17 7

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in November, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol. First Quality.	Bristol. Second Quality.	Liverpool. First Quality.	Liverpool. Second Quality.	London. First Quality.	London. Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	14 9	13 6	—	—	15 6	14 3
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	128 0	121 0	127 0	124 6	124 0	120 0
,, Factory ..	108 0	98 6	107 0	97 0	108 0	104 0
Danish ..	—	—	132 6	129 6	132 0	130 0
French ...	—	—	—	—	131 0	127 0
Russian ...	110 0	103 6	109 0	104 6	110 6	106 6
Australian ...	126 0	116 6	125 0	120 6	123 6	119 0
New Zealand	129 0	127 0	129 0	125 0	126 6	124 6
Argentine .	124 6	120 6	123 6	121 6	121 6	118 6
CHEESE:—						
British—						
Cheddar ..	80 0	74 0	77 6	73 6	83 0	76 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire . ..	—	—	75 0	68 0	82 6	77 0
			per cwt.	per cwt.	per cwt	per cwt
Canadian	65 6	63 0	65 6	63 0	66 6	65 6
BACON:—						
Irish (Green)	74 6	69 6	73 0	69 6	75 0	71 6
Canadian (Green sides)	70 6	68 6	68 6	66 6	69 0	66 6
HAMS:—						
Cumberland (Dried or Smoked) ..	—	—	—	—	139 0	130 0
Irish (Dried or Smoked)	—	—	—	—	127 0	118 0
American (Green) (long cut) ...	74 6	70 0	70 0	67 0	—	74 0
EGGS:—	per 120.	per 120	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	20 10	18 4
Irish	17 1	15 10	16 7	14 3	16 10	14 10
Danish ...	—	—	16 0	14 7	17 10	15 7
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
British Queen ...	77 6	70 0	—	—	75 0	60 0
Edward VII. .	83 6	73 6	51 6	46 6	73 6	60 0
Up-to-Date . .	73 6	65 0	48 6	43 6	70 6	60 6
HAY:—						
Clover	—	—	92 6	73 6	89 0	83 6
Meadow	—	—	—	—	78 0	70 0

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	NOVEMBER. 1913	NOVEMBER. 1912.	ELEVEN MONTHS ENDED NOVEMBER. 1913	ELEVEN MONTHS ENDED NOVEMBER. 1912.
Anthrax:—				
Outbreaks	76	62	528	701
Animals attacked	81	73	581	794
Foot-and-Mouth Disease:—				
Outbreaks . .	1	—	1	82
Animals attacked . .	23	—	23	639
Glanders (including Farcy):—				
Outbreaks	12	17	138	165
Animals attacked	19	33	331	304
Parasitic Mange:—				
Outbreaks .	128	155	2,207	2,635
Animals attacked	222	269	4,337	5,554
Sheep-Scab:—				
Outbreaks	39	69	180	255
Swine-Fever:—				
Outbreaks	286	249	2,334	2,728
Swine Slaughtered as diseased or exposed to infection ..	2,581	3,815	29,521	37,312
Tuberculosis:—				
Number of Premises notified	532	—	*3,760	—
Number of bovine animals notified as for slaughter	569	—	*4,104	—

* Since 1st May, when the Tuberculosis Order came into operation.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	NOVEMBER. 1913.	NOVEMBER. 1912.	ELEVEN MONTHS ENDED NOVEMBER. 1913.	ELEVEN MONTHS ENDED NOVEMBER. 1912.
Anthrax:—				
Outbreaks ...	—	—	—	3
Animals attacked	—	—	—	3
Foot-and-Mouth Disease:—				
Outbreaks	—	3	—	68
Animals attacked	—	26	—	382
Glanders (including Farcy):—				
Outbreaks .. .	1	—	1	—
Animals attacked ..	1	—	1	—
Parasitic Mange:—				
Outbreaks ...	3	3	112	60
Sheep-Scab:—				
Outbreaks ..	51	52	474	337
Swine-Fever:—				
Outbreaks	3	10	130	204
Swine Slaughtered as diseased or exposed to infection .	78	71	847	1,652

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CAN SELECTION IMPROVE THE QUALITY OF A PURE STRAIN OF PLANTS?

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IT is generally claimed by seed-merchants that continued selection gradually improves varieties of agricultural plants, and that unintermitted selection is indispensable to keep their quality up to standard. The majority of people believe that, as soon as selection ceases, the variety will begin to deteriorate. It is for this reason that a high price is paid for seed of a good variety to the man, who either originated the variety, or who continues its selection. In the case of some plants only the seed which leaves the hands of the seed-merchant is used, while in other cases the seed is grown for two or three generations. In the latter case the value of the seed drops lower with each generation.

It is evident that it is of the utmost economic importance to know how far this belief, that unselected seed deteriorates, has a foundation in fact.

The qualities and characters of each individual plant result from the whole development of this individual, and this development we now know to be, in its turn, the result of a great number of causes or factors. Some of these factors we know to influence the plant's development from the outside, such as light and water and salts, but we also know that there are other factors which control the development of the plant and which must be transmitted through the seed from one plant to its daughter-plants. It is these transmitted factors which are responsible for the permanent differences observed between plants of different varieties, and these differences remain even if plants of the two varieties are grown under the influence of identical environment. We now know that the difference

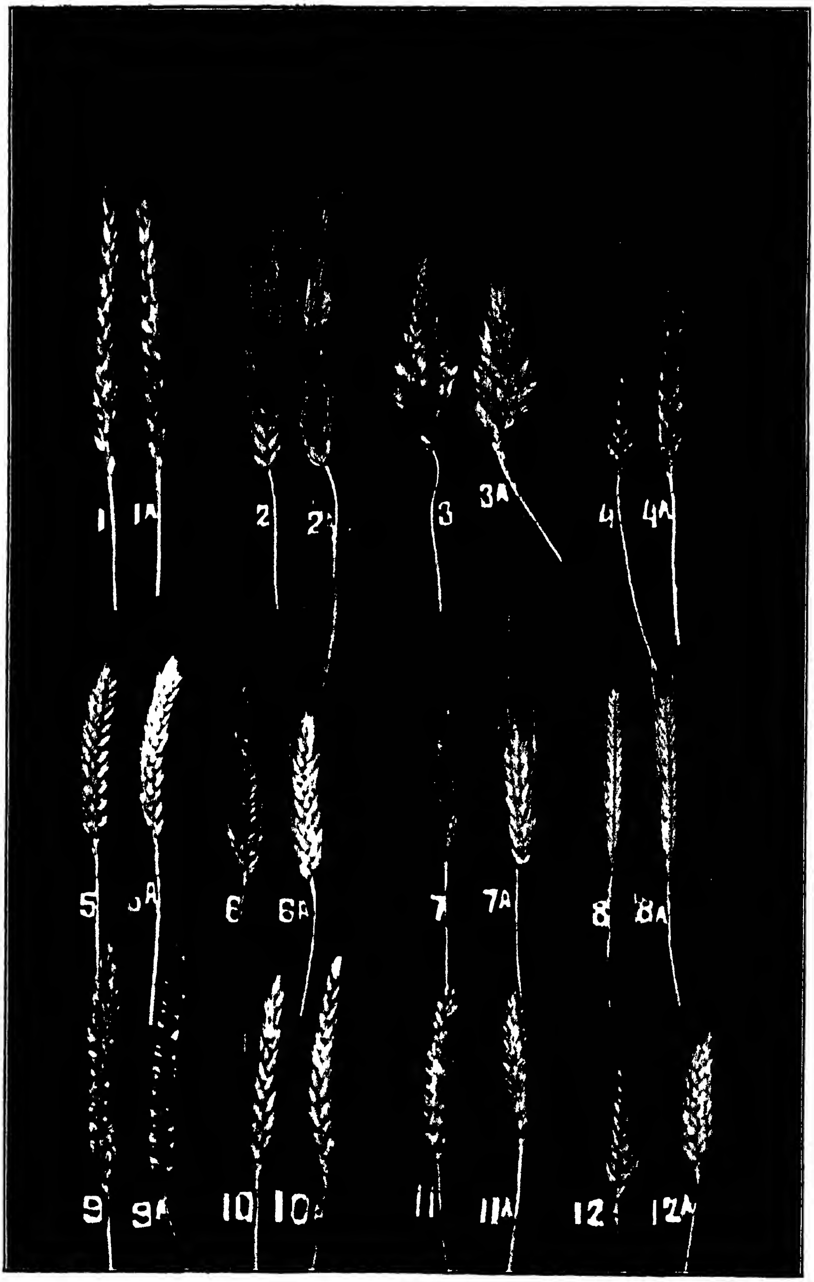
between a hairy and a glabrous wheat-plant is due to the presence, in the seed from which the former grows, of an inherited factor which is not present in the seed from which the latter grows.

We now know also that in respect to such inherited factors a plant may be either pure or impure. It is pure if it inherited the factor in both halves of its germ, impure if only in one. If it is pure, all its seeds will be pure. If it lacks the factor, all its seeds will lack it. If a plant is impure for any inherited factor, we have a complication. Some of its seeds will give plants which are impure, but some of its children will lack the factor, and others will be pure in regard to it.

If we start with one single plant about the developmental factors of which we know nothing, it may, in respect to a given factor, X, be pure, or impure, or it may lack X. In the first and last cases all its descendants will in respect to X be identical. They all have it, or they all lack it. If it be impure for X, only half the number of its children will be impure; of the rest, some will be pure, some will lack it. If, therefore, we choose one daughter-plant of our plant at random, we have, even if this last were impure, a 50 per cent. chance that the daughter-plant will *not* be impure in respect to X. By continuing to take one daughter-plant in each generation, in very few generations our strain becomes automatically pure for all the genetic developmental factors it contains. This is of course only true if no crossing occurs. In self-fertilizing plants continued selection of one plant in each generation automatically makes a strain which is pure for all inherited factors, no matter how impure the plant we started from may have been. About 1850 Louis de Vilmorin empirically discovered this principle. In the breeding of self-fertilized plants, his procedure of taking only one plant in each generation is now of almost universal application. A strain, which has been so bred is, as we saw, pure for all its inherited factors. If, therefore, selection could still alter its qualities, this would prove that selection could alter the quality of the individual inherited factors.

Can selection do this? Has selection any effect on a pure strain, or is such a pure strain unalterably pure as long as no crossing occurs?

Johannsen has shown, in breeding experiments with beans, that such strains are really absolutely pure, and that selection in such strains has no effect whatever. Selection or no selection, the strain retains intact its inherited constitution.



SELECTION OF WHEAT.

1, 2, 3—12.—The original ears from plants selected by Louis de Vilmorin about 1850.
1*a*, 2*a*, 3*a*—12*a*.—Ears of descendants of the original plants (from yearly single plant-selections) grown in 1911.

(Note that no appreciable differences can be detected.)

Some authors have stated that in their opinion these selection experiments of Johannsen are inconclusive, because of the small number of generations during which they have been made. They thought it possible, that even if no effect of the selection were felt in two or three generations, in ten, or twenty, or thirty generations the steady influence of selection would make itself appreciable. It is evident that it is not an easy matter to put this idea to the test. Such experiments would take too long a time. But they are happily also superfluous, for such experiments have been made on a big scale. Some sixty years ago, about 1843-1850, Louis de Vilmorin started growing different varieties of wheat. He made a collection of the most important commercial varieties of his time, and when he procured a new one, he put an ear away as a sample, labelled and dated. From this original plant he selected one single daughter-plant, from this again one and so on. The collection has been added to by himself, and later by his son and his grandson, until now it comprises about 1,800 varieties. The original specimen ears, kept by Louis de Vilmorin, were re-discovered in a drawer by M. Meunissier, the genetician of the firm of Vilmorin, in 1911. Every one of these ears was dated and labelled by Louis de Vilmorin, and, though somewhat browned by age, was preserved in excellent condition. We took one dozen of these specimen ears and compared them with the corresponding specimen ears of the 1911 harvest. One of us photographed them side by side. In the accompanying illustration the old ear is shown on the left, the 1911 one on the right of each pair. In each case the new ear is from a plant which is the direct descendant of that from which the old one is taken. Half a century of selection lies between them. In long-eared plants, the plant with the longest ears was continually chosen, in compact-eared varieties the plant with the compactest ears, and so on. The result of this selection in an already pure strain can be judged from the photograph. In no respect has this long-continued selection been able to effect a change.

Once a strain is pure for all its genetic factors, is it possible to grow its seed without selection for a great number of generations without fear of its deteriorating? Assuredly it is, provided the strain *is* pure. Wheat, or barley, which has been rendered pure by individual selection, and of which every plant descends from one individual plant some generations back, can be grown for as long as it can be kept free from

admixtures. If a seed-merchant sells a mixture, in which some seeds, even a small minority, belong to a strain which does not quite come up to the standard, this seed cannot be multiplied indefinitely, for there is the risk that plants of the inferior strain may take the upper hand.

Seed of self-fertilized plants, which has been derived from one single plant of a pure strain, by some generations of multiplication, is as good after ten or twenty, as after three or four generations when it leaves the seed-merchant. There is really no excuse at the present day for seed-merchants to sell anything but seed of this absolute purity.

Wheat, or barley, or oats can be of so pure a strain that no amount of selection can possibly ameliorate them, no amount of selection in the other direction can deteriorate them.

On the other hand, in the case of habitually cross-fertilized plants, such as rye and beet, continued selection by experts is most necessary in order to keep the quality of the seed up to standard, as under practical conditions no really pure strain can ever be produced by such plants. In these plants the seed deteriorates by multiplication without selection, and it is very probable that, by an unwarranted generalisation, it has come to be believed that the same holds true for all agricultural plants.

FRUIT CULTURE IN NORMANDY.

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Organizer of Agricultural Education for Herefordshire

NORMANDY has, for many years, been famous as a fruit-growing country, largely owing to the combined influences of a suitable sôil, a warm climate, and a thrifty peasantry

On the stretch of land between Honfleur and Caen it is a very common thing to find " flints " in the surface soil. The farm crops growing on this soil are cereals and roots, in addition to certain special crops, such as sainfoin, lucerne, and buckwheat, and the type of farming reminds one very much of that practised in Cambridgeshire, especially in the Ely district.

The one thing, however, which impresses the visitor is the extent of land that is devoted to the growing of cider apples. The trees generally are about 12 to 16 years old, symmetrical, and with nice open heads. About 15 years ago, anyone was allowed to distil spirit from cider without a licence. This proved to be a lucrative business, with the result that cider apple orchards were planted all over Normandy. The

spirit thus obtained became a common beverage of the people, and was the cause of much intoxication in the province. It then became necessary, in order to remedy this evil, to prohibit free distillation, and distillers were licensed. This was done about five years ago. Now there are probably more cider apple trees than are really wanted, and it is a remarkable fact that the varieties are nearly all of the bittersweet type. This explains why the cider made from the apples is not so clear and brilliant in colour as it might be. This could no doubt be remedied by growing some "sharp" or acid varieties, and blending them judiciously with the present varieties. The crops in the past season were very abundant, the young trees being weighed down heavily with fruit. Dessert and culinary apples do not appear to be much grown in Normandy.

At La Rivière St. Sauveur the fruit plantations of the "Syndicat de Production" extend to 50 acres, and are managed on co-operative lines. M. le Cam, the President, takes great interest and an active part in the management of these plantations, which are mostly enclosed with walls about seven feet high. The walls are mostly covered with pear trees, trained on a framework on the wall as espaliers. The part within the enclosure is planted with pear trees intercropped with red currants. In one plantation the pear trees were planted very thickly, approximately 9 feet by 7 feet, with a red currant bush between. In another case the rows of pear trees were 6½ feet apart and the trees 13 feet apart in the rows. Between the rows of pear trees were complete rows of red currants.

The varieties of pear trees grown were much the same as the varieties grown in this country. Williams' Bon Chrétien was well represented, also Beurré Diel, Clapp's Favourite, Conférence, and Lincolns—an American variety which grows to an enormous size—while on the walls were chiefly Winter Doyenné, which is the most valuable pear grown here, and Passe Crassane. The variety of red currants was one which grows strong wood and is very large in size, somewhat like the Boskoop Giant in the blacks. This red currant is a selection of the Association and does not yet appear to have been named.

The pear trees were about ten years old, very healthy, and pruned in such a way that the branches came direct from the main shoot, side branches from these not being allowed. Some of the trees, however, had been pruned on what is known as the "Laurette System," which has been somewhat popular of late in this district. Under this system the whole of the pruning

is done between May and the beginning of September, the idea being to encourage the growth of fruit buds.

M. le Cam, however, is not greatly impressed with this system, because in May the shoots in his plantations are not long enough to pinch back, and he prefers to wait till the side shoots are 10 inches long before pruning. The system also needs a lot of attention at a very busy time of the year, and does not tend to a satisfactory distribution of labour throughout the year.

Another objection M. le Cam has to this system is that his soil is very rich and forces the buds on after pruning into shoots. The pruning has therefore to be delayed till the fruit buds are formed, after which there is no danger whatever.

With regard to the pollination of the flowers and the setting of the fruit, M. le Cam has had the same experience as many fruit growers in this country, because when he planted a patch with only "Williams' Bon Chrétien" pears, he did not get nearly such satisfactory results as when he had this pear alternating with other varieties.

The ordinary scab, or as they call it, "Black Scab," is the chief fungoid pest which is troubling them at present. It is found that spraying the trees with soda Bordeaux or Burgundy mixture at frequent intervals during the year is effective in preventing this disease. In winter, however, they find it cheaper and apparently effective to use a 7 per cent. solution of sulphate of iron in place of the soda Bordeaux.

When the wasps and birds begin to attack the pears, the fruits are each enclosed in a small paper bag, usually translucent, to allow the light to pass through, and held in position by a thin narrow strip of lead about 2 inches long. This is just bent round the neck of the bag with the fingers, after it has been slipped over the pear. This clip is quite effective and exceedingly handy. It can be taken off and replaced as often as necessary. Although these bags do not allow the pears to colour up quite so much as they would otherwise do, the growers have to choose between saving the pears from wasps, etc., and a medium colour. A certain amount of colour can be obtained by removing the bags as soon as the wasp season is over, and this is practised to some extent.

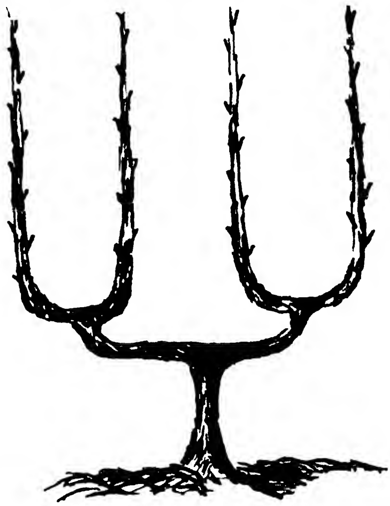
The pears which are being grown are large and of considerable value. Hence the packing has to be carefully done. Special boxes are made to suit the size of the particular variety of pear, and the pears are packed, in the case of the more valuable varieties, in single compartments, like eggs. For less expensive

varieties, a layer of fine wood shavings is laid on the bottom of the box, and on top of this, a layer of paper. Round the sides of the box are " packing rods," made of wood shavings, rolled up in grease-proof paper, like huge cigarettes (the machine used for making them was copied from the small cigarette-making machines). These rods are generally 30 inches by 1¼ inches, and can be bought at approximately 20s. per thousand. The pears are then placed in single layers in the box and covered over with paper and shavings. In some cases they may be packed two or three layers deep if the variety is comparatively small.

Most of the pears from these plantations at La Rivière St. Sauveur are exported to Russia and sell for high prices, many of them realising about sixpence each.

In the neighbourhood of Magny la Freule the training of the pear trees on the walls is done in such a thoroughly skilful and uniform manner that one suspected that it must be due to an

The " U " system of training pear trees.



The Double " U " system of training pear trees

expert supervisor, and such proved to be the case, for M. l'Abbé Bellière, in addition to undertaking the duties of parish priest and operator of a wireless telegraphy apparatus, is a keen horticulturist, who gives a great deal of help to fruit growers. The fine wall pear trees at La Chateau de Manneville, the home of M. le Comte de Larbre, are also trained and supervised by M. l'Abbé Bellière. His favourite method of training the wall pears is on the " U," or double " U " system. The walls are covered with a light frame-work with vertical supports, to which the branches of the trees are tied, approximately 12 inches to

14 inches apart. In the "U" system of training a single branch cordon would be planted between every second vertical rod of the frame-work and cut hard back. The following spring the two best shoots would be selected and tied with raffia, first horizontally and then to the two vertical supports to each rod. These are allowed to grow, but the side shoots are summer-pruned in July and those which tend to produce shoots instead of fruit buds are cut hard back in August. The leading shoots may be cut back at the end of the growing season.

The double "U" system differs from the "U" in the tree having four leading shoots instead of two. These leaders are all trained vertically and not at an angle. The diagram shows the method of training at a glance. The same method applies in most cases to trees on wirework. The trees, trained in this way along the walls, look exceedingly neat, and it is usual to plant pear trees on both sides of the wall. Generally speaking, the earlier varieties are grown on the side of the wall which gets least sun, *e g*, Beurré Giffard, André des Portes, and Poire Belle Angevine. The last-named variety grows to an enormous size, and in 1912 M. l'Abbé Bellière grew one which weighed over four pounds. Other later pears which may also be grown on the side getting the least sun are Louise Bonne and Duchesse d'Angoulême, the latter a fine looking pear but somewhat deficient in quality.

On the walls exposed to the sun, Doyenné du Comice, Beurré Superfin and Beurré Diel were carrying fine fruits, in addition to Josephine de Malines, Durondeau (De Tongrès), Williams' Bon Chrétien, Beurré Hardy, Comtesse de Paris, etc.

In some cases an intermediate stock is necessary to get the best results, *e g*, "Passe Crassane" had been grafted on a "Quince" stock. After the grafts had grown sufficiently, the tree was regrafted with "Beurré Crassane."

Sometimes there are parts of the stem which do not fruit, and in order to remedy this fault fruit buds are taken from other trees of the same variety and budded on these bare parts, with the result that these buds soon commence to bear fruit. This budding should be done about August.

One rather striking difference between houses in England and those in Normandy is that the latter do not grow Virginia creeper and ivy on the walls, as it is preferred that the external walls of the house should be covered with pear trees. The latter are quite as ornamental as ivy, etc., if properly trained; the flowering trees are exceedingly beautiful, and the fine mellow pears in autumn appeal to one in a practical fashion.

Many of the walls of English houses and in English gardens are not being utilised at all for fruit, and this is a great pity, for although it may not be advisable to cover our walls and houses with pear trees alone, there are many other kinds of fruit trees which could be usefully employed.

The wages of labourers in the Magny la Freule district may be of some interest. These are approximately as follows :—

Labourer without board and lodging	3 francs per day.
Labourer with food but no lodging	2 francs per day.
Labourer in summer	3½ francs per day
Labourer, with free cottage on farm	40 to 50 francs per month.
Boy, with board and lodging ..	20 francs per month.
Women, with perquisites	1½ to 2 francs per day.

The equivalent of a franc in English money is nearly tenpence, hence the cost of labour is slightly less in Normandy than in many parts of England.

SOME DOUGLAS FIR PLANTATIONS.

IV—TORTWORTH WOOD, GLOUCESTERSHIRE.

THE Tortworth Wood is the property of the Rt. Hon. the Earl of Ducie, by whose courtesy facilities were afforded to the Board's officers for making a detailed examination. Part of the wood was planted in 1872 and part in 1883.

1.—*Geographical Position and Area.*

The wood is situated in the parish of Tortworth in Gloucestershire, and is 18 miles N.N.W. by N. from Bath, and 4½ miles from the River Severn. The area of the portion of the wood stocked with Douglas fir is 3.28 acres.

2.—*Altitude, Aspect, Exposure and Slope.*

The wood is situated on a gentle to fairly steep slope on the left and southern bank of the stream called the Little Avon. The lowest point is 60 feet and the highest 90 feet above the sea. The aspect varies from due north to north-east.

There is good to partial shelter from north and north-east winds by the rising ground on the right bank of the Little Avon; this rising ground is about half-a-mile away and the angle of protection afforded by it is 7 deg. at the base and 2 deg. at the top of the wood. In the direction from which the prevailing winds come, that is the S.W., the Douglas firs till a few years ago have been excellently protected by the hill on

which the wood is situated, and by a coppice with standards and a larch wood which for the most part occupy a contour near the top of the hill. The position of these two woods is shown on the map, the copse sheltering the younger portion, and the larch the older part of the Douglas fir wood. The copse, being well stocked with standards, gives better protection than it would otherwise be able to afford. The larch appear to be of about the same age as the older Douglas firs.

A few Douglas firs are 5 ft. to 10 ft. higher than the top of the coppice with standards and so for the last few years have had no protection as far as this upper 5-10 ft. is concerned, either from the hill on which the wood is situated or from the copse. The only protection afforded in their case is by a line of hills to the south, 1½ miles away, which gives an angle of protection of 2 degrees. These trees also showed no sign of damage by wind.

3.—*Geology and Soil.*

The geological formation is the Upper Llandovery Sandstones series of the Silurian.

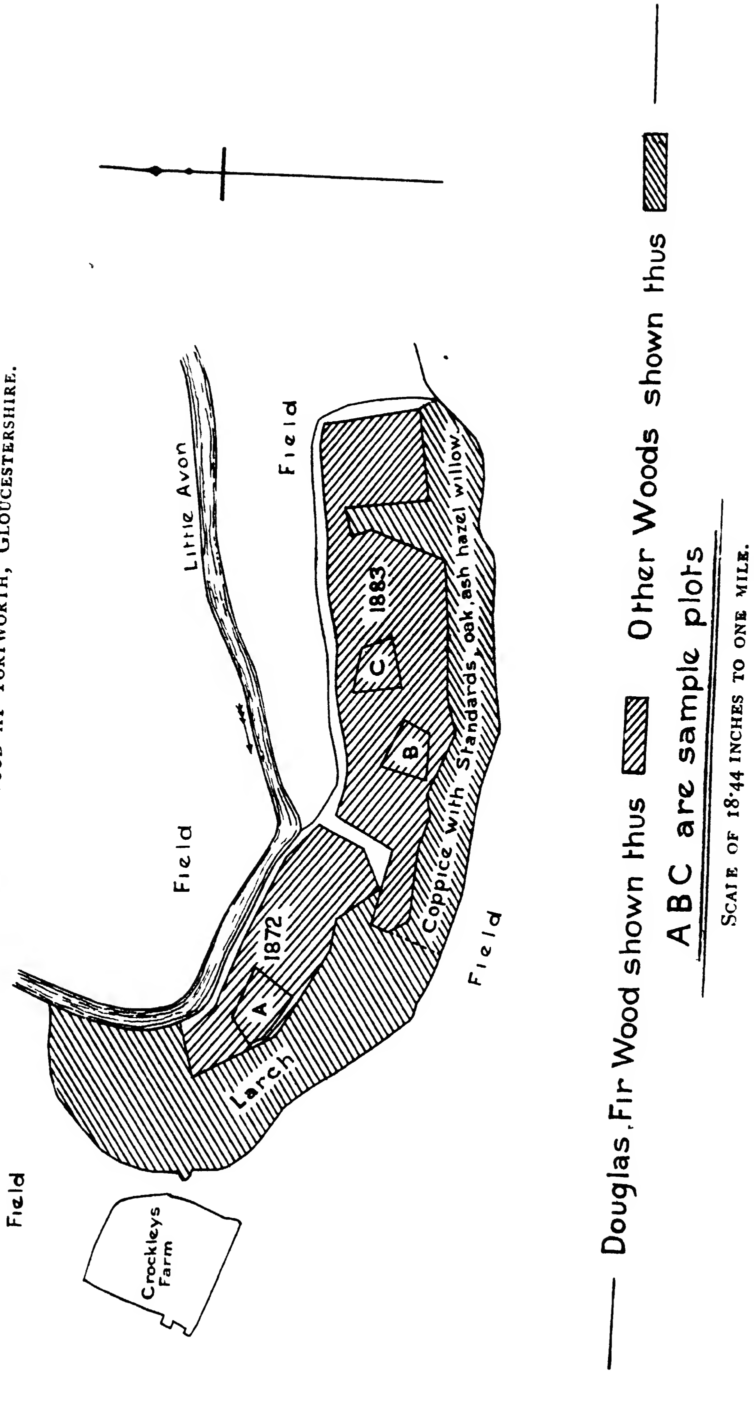
To ascertain the nature of the soil and subsoil two holes were dug, one in the older and the other in the younger plantation. In the former the soil consists of 2 inches of humus covering 3 inches of brown loam, while the subsoil is a reddish loamy clay mixed with pieces of micaceous and fossiliferous sandstone, the proportions of sandstone and loamy clay being about equal. The holes reached a depth of 3 ft. 10 ins., but the bottom of the subsoil was not reached at this depth. The subsoil was decidedly wet, and there are a few very wet spots in the wood where small springs come out.

The hole in the 1883 plantation disclosed similar soil and subsoil to that in the portion planted in 1872, except that the layer of humus was only half as thick—an interesting fact.

4.—*Climate.*

Cheltenham is twenty-two miles N.N.W. of Tortworth, and is a meteorological station of the second order. Both Tortworth and Cheltenham are in the valley of the Severn, and in the same meteorological sub-division, and their altitude only differs by 120 feet. The climate of Cheltenham probably differs little from that of Tortworth, and hence, for the purpose of these notes, the figures of rainfall and temperature for Cheltenham can be taken to apply with sufficient accuracy to the Douglas fir wood. The averages for the twenty-seven years, 1879 to 1905, are as follows :—

DOUGLAS FIR WOOD AT TORTWORTH, GLOUCESTERSHIRE.



SCALE OF 18·44 INCHES TO ONE MILE.

(*a*) *Rainfall.*—Total annual rainfall 26.65 inches. Number of rainy days annually, 185. Rain falls in every month of the year.

(*b*) *Temperature* in the shade :—

Maximum, 90.5 deg. Fahr.
Minimum, 3.3 deg. Fahr.
Mean maximum daily temperature, 55.9 deg. Fahr.
Mean minimum daily temperature, 40.8 deg. Fahr.

5.—*History of the Wood.*

Before the planting of the Douglas fir the ground was covered with a rough coppice-with-standards wood of oak, ash and hazel; this was clear felled and planted up with practically pure Douglas fir. The plants were purchased when quite small, then put into the estate nursery, and when 3 ft. to 4 ft. high were planted out in the wood at a distance of 12 to 15 ft. apart. The western portion of the area, covering 1.02 acres, was planted up in 1872, and the eastern portion, covering 2.26 acres, in 1883. From the evidence of the wire netting, which is still to be seen in many cases adhering to the trees, it is evident that each plant, at any rate in the 1883 plantation, was surrounded by a cylinder of rabbit netting, 10 ins. in diameter. There is no record of the cost of planting or weeding. It seems that the coppice shoots from the stumps of the old copse were cut back and removed when big enough for pit wood, the last being removed some ten to twelve years ago.

No Douglas firs have been cut out in clearings or thinnings.

6.—*Condition of the Wood.*

(*a*) *Method of Examination.*—The portion planted in 1872 was measured separately from the portion planted in 1883. The boundaries of the different portions of the wood were carefully surveyed. The diameter of every tree in each portion was taken by calliper at 4½ feet from the ground, the trees being booked in inch-diameter classes. The trees were then arranged in diameter classes as shown in Table No II, and the total sectional area at 4½ feet of each diameter class being obtained, the sectional area of the average tree representing each class was worked out. Sample trees were then selected for each class with a diameter corresponding as nearly as possible to the average tree of the class. Endeavour was made to obtain three sample trees for each class, and this was found possible except in the case of the smallest and largest diameter classes of the 1872 wood and of the largest

class in the 1883 wood. In these three classes only two sample trees were measured. Thus 27 sample trees in all were selected.

As arrangements could not be made to fell any sample trees, it was necessary, in order to find the volume of timber, to send up a man with a tape to the point where the diameter of the bole scaled three inches, and to measure the size of the bole half way between this point and the ground. This was done in the case of all the 27 trees. The total height of each tree was also taken with Brandis' hypsometer

Three normally stocked sample plots, totalling 0.32 acres, were found and were separately measured, one being in the older and the other two in the younger plantation. The position of these plots is shown on the map. Details of these measurements are given in the Tables.

Information was in this way obtained for calculating for each of the two portions—

(*i*) The volume and annual increment per acre of the whole wood and of the normally stocked plots, and

(*ii*) The form factor

(*b*) *Stocking.*—The stocking per acre is as follows —

Kind of Tree	Number of Trees		
	Dead.	Suppressed	Dominant
1872 *Wood, sample plot*—			
Douglas Fir . .	1	—	215
1872 *Wood, whole*—			
Douglas Fir . . .	5	4	141
Larch . . .	—	—	2
Total	5	4	143
1883 *Wood, sample plots*—			
Douglas Fir . .	—	1	205
1883 *Wood, whole*—			
Douglas Fir	2	1	166
Oak and Ash . . .	—	12	14
Other conifers . . .	—	1	5
Total	2	14	185

The normal stocking per acre for the two woods combined can therefore be taken as 210.

How the two larch got into the 1873 plantation is not known, but they are fine trees of equal height growth to that of the Douglas fir and of 14 inches and 19 inches diameter respectively.

The oaks and ashes are poor specimens and are either already suppressed by the Douglas firs or will be in a few years time; they are from 3 inches to 9 inches diameter and must have been naturally regenerated.

The "other conifers" are specimens of *Cupressus Lawsoniana* (1), *Cupressus macrocarpa* (9), and *Sequoia sempervirens* (4), which were planted with the Douglas firs in the 1883 wood; the *C. Lawsoniana* is suppressed; the *C. macrocarpa* and *S. sempervirens* are healthy, the height-growth of the former being less than, and of the latter equal to, that of the Douglas firs. The Douglas fir, however, puts on greater diameter growth than either of these species.

(*c*) *Diameter-Growth.*—In the 1872 wood the average diameter of the trees in the normally stocked sample area is 15.1 inches, corresponding with an annual increase of 0.38 inch. The largest trees in this area were of 18 inches diameter. The largest trees in the whole wood were of a diameter of 24 inches, but these abnormally big trees were on the edge of the wood. The sample plots were naturally taken so as not to include any trees that were grown under abnormal conditions. In the 1883 wood the average diameter of the trees in the normally stocked sample areas is 12.3 inches, corresponding with an annual increase of 0.42 inch, which is rather larger than in the case of the older wood.

The trees of largest girth in this 29-year-old wood were one of 23-inch and two of 22-inch diameter; these were on the southern edge of the wood and show the huge diameter increase of 0.77 inch a year.

(*d*) *Height-Growth.*—The height-growth curve of the older plantation (see p. 872) was obtained by measuring the space between the whorls of a wind-fallen tree and of sample tree No. 12. It will be seen that as yet the rate of growth is falling off but little. The figures for total height and height to three inches diameter of the sample trees are as follows:—

Wood.	Total Height (ft.).			Height to 3 ins. diameter (ft.).		
	Min.	Max.	Aver.	Min.	Max.	Aver.
1872 *Wood.*						
Total	81½	106	97¼	69	96¾	85¾
Increase per ann.	2.04	2.65	2.43	1.72	2.42	2.14
1883 *Wood.*						
Total	60½	80½	66¼	26	62	51¼
Increase per ann.	2.09	2.77	2.28	.9	2 14	1.76

The longest measured shoot of any one year was 4 feet 9 inches.

(*e*) *Volume of Timber.*—The figures showing the calculation of the volume of timber are given in Table No. II. The volume of each class was obtained by calculating the volume of the sample trees representing the class and then using the equation :—

$$\frac{\text{Volume of whole class}}{\text{Volume of sample trees}} = \frac{\text{Sectional area at } 4\tfrac{1}{2} \text{ ft. of all trees in class}}{\text{Sectional area at } 4\tfrac{1}{2} \text{ ft. of the sample trees.}}$$

All figures are for volume over bark, true measurement. The results are as follows :—

Wood.	No. of Trees per Acre.	Vol. of Timber in cub. ft.			
		Total per Acre	Per Tree.	Average Annual Increment.	
				Per Acre.	Per Tree.
1872 Whole Wood ..	141	7,370	52	181	1.3
1872 Sample Area ..	215	9,320	43	233	1.1
1883 Whole Wood ..	166	3,820	23	132	.8
1883 Sample Area ..	205	4,700	23	162	.8

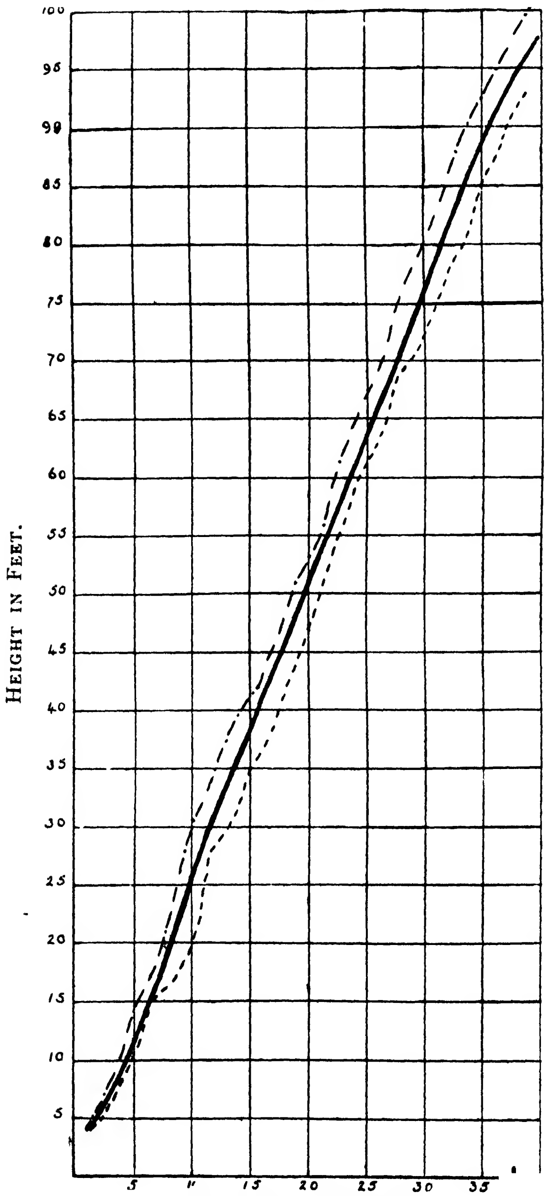
The chief points of note are :—

(1) The very large yield.

(2) The small number of trees per acre and the consequent large yield per tree.

(3) The increase in the annual increment between the ages of 29 and 40.

Height-growth Curve.



——Height-growth curve.
The broken lines are the height-growth curves of the trees of which the internodes were measured.
\- - - - - - - A felled tree.
—·—·—· A standing tree

I.—TREE ENUMERATION.

Excluding Dead and Suppressed Trees.

Diameter Class in inches.	1872 Wood: Species.	1872 Wood, Number of Trees: Sample Plot A (.13 acres).	1872 Wood, Number of Trees: Remainder (.89 acres).	1872 Wood, Number of Trees: Whole Plantation (1.02 acres)	1883 Wood: Species	1883 Wood, Number of Trees: Sample Plot B (.09 acres)	1883 Wood, Number of Trees: Sample Plot C (.10 acres).	1883 Wood, Number of Trees: Remainder (2.07 acres).	1883 Wood, Number of Trees: Whole Plantation (2.26 acres).
4½–5½	—	—	—	—	Douglas ..	—	—	2	2
					Oak, Ash	—	—	2	2
5½–6½	—	—	—	—	Douglas	1	—	14	15
					Oak ..	—	—	7	7
					Cupressus macrocarpa	—	—	1	1
6½–7½	--	—	—	—	Douglas	1	1	19	21
					Oak, Ash	—	—	13	13
					Cupressus macrocarpa	—	—	2	2
7½–8½	Douglas	—	1	1	Douglas ..	1	—	11	12
					Oak, Ash	—	—	7	7
					Cupressus macrocarpa	—	—	1	1
8½–9½	"	—	2	2	Douglas	—	1	22	23
					Oak	—	—	3	3
					Cupressus macrocarpa	—	—	1	1
					Sequoia sempervirens	—	—	2	2
9½–10½	"	—	2	2	Douglas	2	1	29	32
					Cupressus macrocarpa	—	—	2	2
					Sequoia sempervirens	—	—	1	1
10½–11½	"	2	5	7	Douglas	5	3	41	49
					Cupressus macrocarpa	—	—	1	1
11½–12½	"	3	8	11	Douglas	6	—	45	51
12½–13½	"	2	9	11	"	1	4	46	51
					Cupressus macrocarpa	—	—	1	1
13½–14½	"	5	10	15	Douglas	1	3	32	36
	Larch	—	1	1					
14½–15½	Douglas.	1	15	16	Douglas .	1	2	26	29
15½–16½	"	7	12	19	"	1	2	23	26
16½–17½	"	6	9	15	" .	—	1	8	9
17½–18½	"	2	14	16	" .	—	1	3	4
18½–19½	"	—	11	11	" .. .	—	—	5	5
	Larch	—	1	1		—	—	—	—
19½–20½	Douglas.	—	4	4	Douglas .	—	—	2	2
20½–21½	"	—	5	5	"	—	—	4	4
21½–22½	"	—	5	5	"	—	—	3	3
22½–23½	"	—	2	2	" .	—	—	1	1
23½–24½	"	—	2	2		—	—	—	—
Totals	Douglas.	28	116	144	Douglas .	20	19	336	375
					Oak, Ash .	—	—	32	32
	Larch.	—	2	2	Cupressus macrocarpa	—	—	9	9
					Sequoia sempervirens	—	—	3	3
Per acre	Douglas.	215	130	141	Douglas	222	190	162	166
					Oak, Ash	—	—	15	14
	Larch.	—	2	2	Cupressus macrocarpa	—	—	4	4
					Sequoia sempervirens	—	—	1	1

II.—CALCULATION OF VOLUME OF TIMBER.

Diameter class	Diameter of representative tree	Actual Trees Measured: Serial No	Diameter: At 4 ft. 3 in.	Diameter: At half height to 3 in. diameter	Sectional area: At 4 ft. 3 in	Sectional area: At half height to 3 in diameter.	Height: Total	Height: To 3 in diameter	Volume of timber to 3 in diameter	Sectional area of all Trees in class	Volume of Timber: Total	Volume of Timber: Per acre: Total	Volume of Timber: Per acre: Average annual increment	Form factor	Sectional area of all Trees in class	Volume of Timber: Total	Volume of Timber: Per acre: Total	Volume of Timber: Per acre: Average annual increment
								1 872 Wood.										
				WHOLE AREA	(1 02 acres)										SAMPLE PLOT A		(13 acres)	
in	in		in.	in	sq ft	sq ft	ft	ft	cub ft.	sq ft	cub ft	cub ft	cub ft		sq ft	cub. ft.	cub. ft.	cub. ft
7½ to 11½	10 300	1	10 625	7 795	.6158	3315	84	69	22 873	6 9435	253	248	6 2	442	1 3200	48	369	9 2
		2	9 625	6 840	5053	2552	81¼	70½	17 991	—	—	—	—	437	—	—	—	—
11½ to 14½	13 134	3	13 000	8 750	9218	4176	89¾	77	32 155	34 8142	1,200	1,175	29 4	389	9 5448	329	2 531	63.3
		4	13 125	8 590	9396	4025	98	84	33 810	—	—	—	—	367	—	—	—	—
		5	13 250	8 590	.9576	4025	93½	77½	31 194	—	—	—	—	349	—	—	—	—
14½ to 17½	16 000	6	15 875	9 864	1 3746	5306	104	95½	50 672	69 8094	2,429	2,381	59 5	354	20 4591	712	5,477	136 9
		7	16 000	10 023	1 3963	5479	98½	86	47 119	—	—	—	—	343	—	—	—	—
		8	16 000	9 864	1 3963	5306	97¼	89	47 223	—	—	—	—	348	—	—	—	—
17½ to 20½	18 626	9	18 437	11 136	1 8539	6765	100½	91½	61 900	58 6583	2,044	2,004	50 1	.332	3 5342	123	946	23 7
		10	18 688	11 136	1 9048	6765	103	92½	62 576	—	—	—	—	319	—	—	—	—
		11	18 437	11 932	1 8539	7766	106	91½	71 059	—	—	—	—	362	—	—	—	—
20½ to 24½	22 096	12	22 063	12 886	2 6549	9057	104	94	85 136	37 2791	1,443	1,415	35 4	308	—	—	—	—
		13	21 812	14 954	2 5950	1 2197	105½	96¾	118 060	—	—	—	—	431	—	—	—	—
				Totals						—	7,369	7,224	181	37	—	1,212	9,323	233.
								1 883 Wood.										
				WHOLE AREA	(2 26 acres)										SAMPLE PLOTS B	C	(09 acres) and (.10 acres).	
4½ to 8½	6 900	14	7.000	5 410	2673	1596	54½	30½	4 8678	13 0198	241	107	3 7	.334	1 0800	20	105	3.6
		15	6 875	5 410	2578	1596	47¾	26	4 1496	—	—	—	—	337	—	—	—	—
		16	7.187	5 727	2818	1789	51	33	5 9037	—	—	—	—	411	—	—	—	—
8½ to 11½	10 280	17	10 312	7 477	5801	3049	67½	52½	16 007	59 9542	1,728	764	26 3	409	7 3580	212	1,116	38.5
		18	10 312	7 636	5801	3181	65¾	54	17 177	—	—	—	—	.450	—	—	—	—
		19	10 188	7 795	5662	3315	71½	50	16 575	—	—	—	—	409	—	—	—	—
11½ to 14½	12 916	20	12 875	9 068	9042	4485	60½	48	21 528	125 5512	3,443	1,523	52 5	.394	13 5974	373	1,963	67.7
		21	12 812	9 068	8954	4485	68¼	54	24 219	—	—	—	—	396	—	—	—	—
		22	12 938	9 864	9131	5306	67	54	28 652	—	—	—	—	.468	—	—	—	—
14½ to 17½	15 700	23	15 562	10 659	1 3200	6197	70½	56	34 703	86 0793	2,240	991	34 2	373	9.4468	246	1,295	44.6
		24	15 687	10 182	1 3422	5655	71½	59	33 364	—	—	—	—	.348	—	—	—	—
		25	15 687	10 341	1 3422	5833	74¾	62	36 165	—	—	—	—	360	—	—	—	—
17½ to 23½	20 600	26	20 125	11 455	2 2091	7158	80½	62	44 380	41 7021	980	434	15 0	250	1.7671	42	221	7.6
		27	20 625	13 682	2 3202	1 0210	70	60¾	62 026	—	—	—	—	382	—	—	—	—
				Totals	.	..		.	.	—	8,632	3,819	132	.38	—	893	4,700	162.

(*f*) *Form Factors.*—Calculating from the known heights, volumes and sectional areas at 4½ feet of the 27 sample trees, the form factor for timber in the round down to three inches diameter is 0.379 in the case of the 40-year-old wood, and 0.385 in the case of the 29-year-old wood. It was considered that these figures might be too low, and some of the sample trees were remeasured, but with the same result.*

(*g*) *Natural Enemies.*—No trace of any fungoid disease or insect attack was noticed, nor any damage by rabbits or squirrels; the wood is fenced from cattle and sheep but not from rabbits.

(*h*) *Value of the Plantation.*—The timber in the older portion is probably worth at least 6*d.* per foot as measured, giving an average value of about £184 per acre for the whole area, or £233 per acre for the well-stocked sample plot.

The cost of planting cannot have exceeded £5, which in 40 years at 3 per cent. compound interest represents £16.31. The net result therefore, exclusive of annual expenses, is approximately £167.7 in the former case and £216.7 in the latter. On a 3 per cent. compound interest basis these figures are equivalent to annual rents of 44*s.* and 57*s.* respectively.

(*i*) *General.*—The canopy has apparently been complete for a good many years, but on account of the trees being spaced so far apart from the first the boles are not clean. There are branches up to 5 inches in girth down to within 3 ft. or 4 ft. of the ground. These branches are mostly dead to within 25 ft. of the ground.

The wide planting has also resulted in somewhat tapering stems, as evidenced by the rather low form factor.

SOME OBSERVATIONS ON A PECULIAR SOIL DISEASE.

WALTER E. COLLINGE, M.Sc.

RECENT investigations upon biological and chemical problems connected with the soil tend to show that there is a fertile field awaiting the investigator, and that the results are likely to exercise a profound and far-reaching influence upon modern agricultural methods.

It is only necessary to instance the recent work of Drs. E. J. Russell and H. B. Hutchinson, who have shown that various soil protozoa "constitute a factor limiting bacterial activity and fertility in ordinary soil." "Not only does

* Calculating from the actual measurement of a wind-fallen tree of 16½ inches diameter in the older wood the form factor is 0·34.

partial sterilisation kill these destructive and competing organisms and thus make the conditions more favourable for the new bacterial flora, but it probably also increases the food supply."

This inter-relation between the protozoa and bacteria of the soil undoubtedly accounts for the condition of many so-called " sick soils " and " soil-diseases," and the trouble about to be described, in all probability falls into the same category. In any case the experimental work that has been carried out during the past seven years is worthy of being placed on record, if only *because it has afforded a complete cure of a condition of things, which if occurring to any general extent would be the cause of very serious financial loss to agriculturists.*

The disease in wheat, oats, rye, mangolds and potatoes described below, was first brought to the writer's notice on a large farm in Warwickshire, early in 1906. Previous to that date there appears to have been no record of the disease, but since then it has occurred on other farms in the county and on one farm in Cheshire.*

In 1906 the writer was asked to make an inspection of some 40 to 50 acres of wheat which were attacked by a disease locally known as " Maysick." The conditions observed were as follows .

In various parts of the field, either in large circular patches or in straggling lines, the wheat plants were turning yellow in the leaf and had only attained a height of about half that of the healthy plants. Later in the season such plants had a scorched appearance, very little growth took place, they did not develop ears, and were of little use for straw. Oats and rye had much the same appearance, whilst mangolds and potatoes turned yellow in the leaf, and growth was arrested to a large extent, with the result that the roots or tubers were undersized.

The farmer stated that he had known the disease on his farm for nearly 40 years, and that various scientific men and agriculturists had examined it at different periods.

After obtaining samples of the soil and manure, and information as to the rotation of the crops, etc., a number of plants were taken up and transferred to the botanical laboratory at the University of Birmingham for further observation.

A careful examination of the soil and manure revealed nothing, but, on pulling up some of the diseased plants and

* Since this was written a somewhat similar disease has been reported to the writer from Nottinghamshire.

washing the roots in water, numerous minute spore-like bodies were found in a microscopical examination of the residue from the roots after filtering, as also very large numbers of protozoa. The former were submitted to a well-known mycologist who pronounced them to be the spores of some fungus, and suggested that an attempt should be made to get them to develop. As a result, all the known methods of germination were tried, but without success, and the search for the specific cause of the disease was abandoned and attention turned to some method of treatment.

As a means of combating the disease it was suggested that experiments should be made with dressings of flowers of sulphur for the soil.

Incidentally it may be pointed out that when mangolds or potatoes were grown on these particular Maysick areas, they did not flourish, and also that when grown on Maysick land treated with sulphur the improvement was very marked, even more so than with the cereals.

About ten acres of a certain field always went Maysick until it was sulphured three or four years ago. It was wheat last year and there were only small patches with the disease, about half an acre in all.

Another field has never grown a successful crop of corn because of Maysickness, the crop generally dying off. In 1910, 6 cwt. per acre of sulphur were applied, the crop being potatoes and mangolds. In 1911, 7 cwt. per acre of sulphur were given and the field was sown with oats ; some of the crop became Maysick. In 1912 it was again in oats, and 5 cwt. per acre of sulphur were used. There was no Maysickness, but the oats were somewhat shorter in the straw. In 1913 the clover looked very promising

In 1910 a third field, in oats, was given 7 cwt. per acre of sulphur. In 1911 it was in clover, and no sulphur was given. In 1912 the crop consisted of mangolds and potatoes, and in May 6 cwt. per acre of sulphur were applied ; while in the autumn of the same year 5 cwt. per acre of sulphur were distributed just before sowing wheat. The wheat was a good crop except for small scattered patches. This field had never been known to grow wheat previous to being sulphured. Mangolds on this field have always turned yellow and mottled in the leaf, and have not been half a crop, until last year, when after the use of sulphur there were not more than half a dozen yellow-leafed mangolds on about three acres, the rest of the crop being a beautiful dark green and the heaviest yield in the district.

Experiments.—In 1910 a series of experiments was commenced, a box of what may be termed "Maysick" soil being obtained and equally distributed on five plots of land. Each plot measured 5 by 2½ feet, and was separated from the others by a space of 6 inches. The soil was a heavy clay.

Plot 1.—In the early spring of 1910 ground unslaked lime was applied at the rate of 12 cwt. to the acre; six weeks later wheat was sown. Almost as soon as it appeared above the ground it was seen to be badly attacked by the disease. It reached a height of from 8 to 12 inches. In the autumn sulphur was applied at the rate of 6 cwt. per acre.

In 1911 a spring sown crop was grown almost free from the disease. The actual number of diseased plants did not exceed 5 per cent. In October a further dressing of sulphur was given at the rate of 6 cwt. per acre.

In 1912 a spring sown crop was grown perfectly free from the disease.

Plot 2.—Ground unslaked lime was applied in the early spring of 1910 at the rate of 15 cwt. per acre. Six weeks later wheat was sown. Throughout the year it appeared very similar to that on Plot 1. In the autumn sulphur was applied at the rate of 6 cwt. per acre.

In 1911 the crop, sown in the spring, was perfectly free from disease. In September ground unslaked lime at the rate of 12 cwt. per acre was applied, followed in October by a dressing of sulphur at the rate of 4 cwt. per acre.

In 1912 a spring sown crop was grown perfectly free from the disease.

Plot 3.—Sulphur was applied in the early spring of 1910 at the rate of 4 cwt. per acre and another similar dressing was applied in October before sowing.

In 1911 the winter sown crop was quite free from disease and, generally, the plants were better than those on Plots 1 and 2. Sulphur at the rate of 4 cwt. per acre was applied in October.

In 1912 a very fine spring sown crop was grown quite free from disease. The plants were an excellent sample.

Plot 4.—In 1910 sulphur was applied at the rate of 8 cwt. per acre before sowing in October.

In 1911 there was little disease, but many of the plants died, no doubt owing to the heavy dressing of sulphur. In October sulphur was again applied at the rate of 6 cwt. per acre.

In 1912 the spring sown crop showed a little disease and the plants generally were undersized.

Plot 5.—This Plot was untreated. Crops were sown in the spring in 1910, 1911 and 1912, and in every case were badly attacked by disease, being worse in 1911 than in 1910, and still worse in 1912.

Summary.—As to the cause of the disease, the view the writer has formed is that it is due to bacteria which interfere with the nutrition of the plant. As regards treatment it would appear that the use of sulphur prevents the appearance of the disease. Applied at the rate of 6 cwt. per acre the cost of treatment works out at about 30*s*. per acre.

ABORTION IN SHEEP.

THE President of the Board of Agriculture and Fisheries appointed a Committee in April, 1905, to inquire, by means of experimental investigation and otherwise, into the pathology and etiology of Epizootic Abortion, and to consider whether any, and if so, what, preventive and remedial measures might with advantage be adopted with respect to that disease.

In 1909 the Committee submitted a Report (Cd. 4742, price 3*d*.) embodying the principal results of their investigations concerning Epizootic Abortion as it occurs among bovine animals, and an Appendix by Sir J. McFadyean and Mr. (now Sir) Stewart Stockman, giving a detailed account of the experiments on which the Report was based. A summary of this Report was published in this *Journal* for September, 1909, page 478.

In the meantime the inquiry was extended by a minute of the President of the Board of Agriculture and Fisheries, dated May 24th, 1909, to include a consideration of the administrative measures which should be taken to deal with cases of this disease in cattle. The Report (Cd. 5279, price 1*s*.), which was presented by the Committee in 1910, dealing with this aspect of the question was summarised in this *Journal* for September, 1910, page 481.

A third Report (Cd 7156, price 2*d*.) has now been presented by the Committee, dealing entirely with abortion in sheep, and in a separately published Appendix (Cd. 7157, price 5*d*.) an account is given of the experimental work on the disease in sheep carried out for the Committee by Sir J. McFadyean and Sir Stewart Stockman.

Microbe of Abortion in Sheep.—In the Committee's first Report it was stated that these investigators had never found the

microbe of cattle abortion in connection with natural outbreaks of abortion among sheep, and that a totally different microbe—a vibrio—had been repeatedly isolated from outbreaks of abortion in ewes, and that it had been successfully used at the laboratory to infect pregnant ewes with abortion experimentally.

Although the Committee are not prepared to say that the vibrio is responsible for all serious outbreaks of abortion among ewes, they have not met with any other specific form of the disease in this species.

The microbe was found to occur both in the short "S" form as well as in various long spirillar forms. The individual organisms vary in length from 1.5 to 3 microns and the breadth is from ¼ to ⅓ of a micron at the middle part, which is broader than the extremities. The appearance of the spirillar forms is very like that of a spirochæte. The vibrio is motile.

Virulent Material and its Vehicles.—The contents of the infected uterus, viz., the exudate, the membranes and the fœtus contain the microbes and are virulent. An important point is that lambs may be born alive from an infected uterus at or about full time.

In the case of *bovine* abortion an infected cow is probably seldom in a position to infect others until the actual time, or shortly before the actual time of abortion, when virulent material is discharged from the uterus. This, however, is not the case with *ovine* abortion. It would appear from the experiments carried out for the Committee that virulent material may be spread about the pastures (*a*) by infected ewes although they may lamb at full time, (*b*) by aborting ewes, and (*c*) by infected ewes long before they show outward signs of being about to abort.

In connection with the dissemination of the disease among sheep, the Report calls attention to the fact that as compared with epizootic abortion in cattle, ovine abortion is enzootic in character, that is to say, it seems to confine its operations to a comparatively small proportion of farms without showing much tendency to become widespread. On the other hand, it is pointed out that a disease does not owe its epizootiological character to its contagiousness alone, but also to the opportunities given it for dissemination. The opportunities which operate in relation to the disease in cattle and not in sheep are as follows:—(*a*) Breeding goes on all the year round in the case of cattle, whereas with sheep it is almost entirely confined to a season, and a considerable interval of rest inter-

veries. (*b*) Cows are frequently sent to the bull on other premises, where the disease may prevail, but this does not apply to ewes to any extent. (*c*) There is a very considerable interchange of in-calf and newly-calved cows through markets, while ewes are practically always tupped on the owners' premises and remain there throughout pregnancy.

The history of some flocks shows that the disease may prevail on the same premises at intervals over a number of years. It is difficult to explain how the virus is kept alive during the long interval between each breeding season, but bridging this interval it is comprehensible that in those outbreaks which have recurred after an interval of some few years a few abortions, not amounting to an outbreak, may have occurred in the intervening years. The circumstances surrounding some outbreaks favour the idea that the vibrio may lead a saprophytic or other existence outside the bodies of the sheep.

Methods of Infection.—The natural channels of infection are the alimentary and genital passages, mainly the former. The Committee considered whether any part in the spread of ovine abortion is attributable to the ram; and they state that it seems most improbable that a ram could spread infection mechanically from ewe to ewe in a flock merely from the fact of having been contaminated by an aborting ewe, because in the great majority of cases both rams and ewes, when the breeding season begins, have been excluded from sexual intercourse for nearly a year, and the ewes must have been free from maternal duties, other than suckling, for about six months. There seems to be only the possibility that a ram from infected premises may be a carrier of infection owing to the upkeep in some way of virus in its body, but of this being actually the case there is no evidence of any consequence.

Symptoms.—No particular symptoms in connection with abortion seem to have been observed in the field except just before the act, when, if the period of pregnancy is advanced, and it usually is, the ligaments are relaxed, the mammæ and the vulva are swollen and a sanious, mucoid discharge is seen around the latter. It is pointed out that a pregnant ewe, which before her time shows soiling of the fleece by sanious material, should be regarded with great suspicion, and the discharge should be examined. The evidence from the field is that many of the fœtuses are putrefying when expelled, and this seems to apply more particularly to those which have died in utero at a comparatively early stage of pregnancy.

It appears that the interval between infection and abortion

varies between 13 and 113 days, and the percentage of abortions on infected premises averages about 23 per cent. As the result of abortion in ewes, inflammation of the womb is not uncommon, and this may end fatally, especially when the contents of the uterus are putrid.

Distribution and Prevalence of the Disease.—Particulars indicating the distribution of the disease were obtained by the Committee by means of replies from farmers to circular letters of inquiry. The proportion of aborting ewes taken by the Committee as indicating that something definite had operated on the ewes was 10 per cent. and over; and of the 476 farmers from whom replies were received the proportion was 10 per cent. and over on 70 farms (or 14.7 per cent.), these infected farms being situated in 24 counties in England, 4 in Wales, and 6 in Scotland. The proportion of barren ewes on the 476 farms was also ascertained, as it was thought that an unduly high proportion might be ascribable to the ewes casting fœtuses unobserved. The proportion of barren ewes was 10 per cent. or over in 26 flocks out of the 476.

Preventive and Remedial Measures.—No particular breed of sheep seems to possess natural immunity to the disease, although some individual animals are apparently more resistant to infection than others; and further, the evidence obtained by the Committee as to the resistability of ewes which had already aborted was in no way conclusive. A few experiments were carried out to ascertain whether immunity could be conferred on ewes by subcutaneous injection of living cultures of the vibrio, but no preventive effects of any value were obtained. Fairly successful results were obtained with an anti-serum, but, owing to doubt as to the constant virulence of artificial cultures of the vibrio, no great importance can be attached to these experiments. Further investigations are proceeding in relation to the possibilities of the serum and also as to drug treatment.

To prevent the spread of infection once the disease has broken out the following measures are recommended:—

Destruction of Virulent Material and Disinfection of Everything contaminated by it.—This is obviously important. The membranes, fœtus, the discharge, and any litter soiled by the material should be removed at once and destroyed. It is even preferable to destroy their virulence on the spot by mixing the material freely with caustic lime and slaking, or enveloping it in straw soaked in paraffin and burning it. Any patches of the pen or pasture which are known to have

been soiled should be disinfected with a strong disinfectant. The boots, clothing, and hands of attendants should be disinfected.

Isolation of Aborting Animals and those which have Aborted.—When a ewe before her time shows a discharge from her genital organs, or should she abort, it is essential that she should be removed from contact with her fellows. The same applies to ewes which have given birth to live lambs prematurely, in which case both the ewes and lambs may be excreting infective material. It would be preferable, of course, to remove the still pregnant ewes when this is possible.

Penning or Folding of Ewes before Lambing.—In some cases it is customary to pen ewes at night towards the end of pregnancy, and it is also not unusual to fold them by hurdles to feed on certain crops. As far as abortion is concerned, these practices may do no harm, so long as there are no infected ewes in the flock; but given one or two cases of abortion occurring in the narrow area of a pen or fold, it will be obvious how great will be the opportunity for other ewes to become infected, and it is pointed out that a ewe may abort from infection acquired only a short time before her normal time to lamb. Of the 70 farmers referred to above as having experienced 10 per cent. or more of abortion, 46 were in the habit of penning or folding their ewes some time before they were due to lamb.

It is advisable, then, not to adopt these practices if they can be avoided, but if they are adopted the greatest vigilance should be exercised in watching for cases of abortion. Should such occur, two courses are open—either to destroy all evacuated material, disinfect the ground, and remove the ewe, or immediately to remove the other ewes to clean ground. The second course is the more to be recommended, if it can be carried out.

Disinfection of the Genital Passages of Ewes which have Aborted.—This may be done by gently injecting an antiseptic wash (3 per cent. pure carbolic acid in water, or corrosive sublimate 1–2,000) by way of the external genital organs. It is advisable to carry out this treatment, because it may have the effect of destroying a certain amount of virulent material which has passed from the uterus into the vagina, and it may also help to prevent further invasion of the passages and womb by hurtful microbes from without. Ewes which have aborted should be put in improvised pens, and treated in the same way until the discharge ceases.

IMPORTS OF AGRICULTURAL PRODUCE IN 1913.

THE total value of the principal articles of food imported into the United Kingdom in 1913 was £213,976,000, as against £206,090,000 in 1912, £190,690,000 in 1911, and an average of £183,247,000 in the eight years 1903-1910. These figures represent the value (cost, insurance, and freight), as declared to the Customs officers at the port of arrival, of the grain and flour, meat and animals for food, butter, cheese, eggs, condensed milk, fruit and vegetables, hops, lard, and margarine, which may be grouped together as agricultural food products in the sense that they compete more or less directly with the home supply.

The increase in value during the past year as compared with 1912 was mainly due to the increased cost of the meat and animals for food imported, the total value of the items included under this heading amounting to £56,744,000, as compared with £49,080,000 in 1912. The imports of grain and flour showed a decrease, viz., from £88,496,000 in 1912 to £85,528,000 in 1913 On the other hand, the value of the dairy produce (butter, cheese and eggs together) imported was greater than in 1912 by the small figure of £547,000.

Cattle and Beef.—The past year has seen a further very large decline in the number of live cattle imported into the United Kingdom, the number received being only 14,743 or less than *one-thirtieth of the imports in* 1894. Only two countries (apart from the Channel Islands) participate in this trade viz., the United States and Canada. The exports to this country from both these countries showed large decreases in 1913 compared with 1912 ; those from the Channel Islands showed a slight increase.

The imports of beef (chiefly chilled and frozen) again showed a large increase—much more than sufficient, in fact, to compensate for the decrease in the imports of live cattle—and amounted in the aggregate to 9,203,310 cwt., the highest figure yet recorded. The imports of fresh beef were extremely small, viz., only 2,426 cwt. The main source of supply of chilled and frozen beef is Argentina, from which country 5,216,022 cwt. of chilled beef, and 1,955,853 cwt. of frozen beef were received. The extension of the chilled beef trade (representing the better class of meat), which has been a noticeable feature of the dead meat trade during recent years, continued in 1913. The total imports from all countries increased

in quantity from 3,876,450 cwt. in 1912 to 5,248,004 cwt. in 1913, and in value from £7,293,473 in 1912 to £9,785,438 in 1913. A point in connection with the chilled beef trade which is worthy of mention is the continuous decline in the supplies from the United States. In 1913 no supplies at all were received from this source. On the other hand Uruguay has now begun to contribute to our supplies of chilled beef, the imports from that country in 1913 being 31,982 cwt. The frozen beef imports decreased in value by £66,170 in 1913. The countries chiefly engaged in this trade are Argentina, Uruguay, Australia and New Zealand. A decline in the year's imports from Argentina and New Zealand was not quite balanced by increases in the supplies from Uruguay and Australia. Uruguay is taking a rapidly increasing share in this trade also (the imports rose from 65,485 cwt. in 1911 to 210,243 cwt. in 1912 and 397,378 cwt. in 1913), while the United States, on the other hand, has dropped out almost entirely. The chilled beef from all sources averaged 37*s.* 3*d.* per cwt., compared with 37*s.* 8*d.* in 1912, while the frozen beef was several shillings lower, viz., 31*s.* 9*d* per cwt., as against 30*s.* 10*d.* in 1912.

The weight of beef represented by the imports of cattle may be estimated at 94,500 cwt., which, added to the imports of fresh and refrigerated beef, make the total receipts of meat of this class from abroad in 1913 9,297,810 cwt., or $22\frac{3}{5}$ lb. per head of the population. In 1912 the figures were 8,335,000 cwt., representing $20\frac{1}{2}$ lb. per head; in 1911, 8,670,000 cwt., or $21\frac{1}{2}$ lb. per head; in 1910, 8,432,000 cwt., or $20\frac{3}{4}$ lb. per head; in 1909, 8,217,000 cwt., or $20\frac{4}{9}$ lb. per head; and in 1908, 8,115,000 cwt., or $20\frac{2}{5}$ lb. per head.

Sheep and Mutton.—There were only 501 live sheep imported in 1913; they all came from Canada during December. The quantity of mutton imported increased slightly from 5,021,529 cwt. in 1912 to 5,338,380 cwt. in 1913. Nearly all of it came in the form of frozen mutton, chiefly from New Zealand (2,200,525 cwt.), Australia (1,665,859 cwt.), Argentina (1,012,347 cwt.), and Uruguay (173,073 cwt.). The quantities received from Argentina were less than in the preceding year, while the receipts from New Zealand, Australia, and Uruguay were greater. The quantity of fresh mutton received was 126,033 cwt., practically all of this coming from Holland. There were no imports of chilled mutton in 1913.

The weight of meat represented by the sheep received alive may be estimated at 295 cwt., which, added to the imports

of fresh and refrigerated mutton, make the total receipts 5,338,675 cwt., this being equal to nearly 13 lb. per head of the population. In the four previous years the total receipts, alive and dead, were 5,030,000 cwt., 5,363,000 cwt., 5,406,000 cwt., and 4,766,000 cwt. respectively, or about 12⅓ lb., 13¼ lb., 13⅓ lb., and 12 lb. per head of the population.

The declared value of the fresh mutton was 51*s.* 5*d.* per cwt., or about 1*s.* 6*d.* above the average of 1912, 1911, 1910 and 1909, and 3*s.* 6*d.* less than the values in the three years 1906-8.

Rabbits.—The receipts of fresh rabbits, chiefly from Belgium, amounted to only 43,614 cwt., and the bulk of the rabbit supply was composed of frozen rabbits from Australia and New Zealand, the former country sending 419,076 cwt., and the latter 62,883 cwt. The value per cwt. of these frozen rabbits was, however, only a little over one-third of the value per cwt. of the fresh Continental supply.

IMPORTS OF LIVE AND DEAD MEAT.

Description.	Quantity		Value.	
	1912	1913.	1912	1913.
	Number.	Number.	£	£
Cattle	48,912	14,743	982,958	304,312
Sheep	15,430	501	23,793	751
Total live animals	—	—	1,006,751	305,063
	Cwt.	Cwt.		
Beef, fresh and refrigerated	8,005,819	9,203,310	13,674,137	16,070,833
Beef, salted	54,199	49,834	113,975	111,070
Mutton, fresh and refrigerated	5,021,529	5,338,380	9,698,783	10,922,727
Pork, fresh and refrigerated	312,739	495,864	830,743	1,369,360
Pork, salted	213,238	240,943	270,265	298,275
Bacon	4,634,099	4,857,890	14,555,548	17,428,881
Hams	897,876	854,995	2,720,379	3,068,251
Meat, unenumerated—				
Fresh and refrigerated	832,975	728,329	1,459,009	1,429,997
Salted	87,844	104,138	114,168	138,409
Meat, preserved	868,696	888,994	3,083,637	3,706,984
Rabbits, dead	430,925	525,578	617,168	781,376
Total dead meat	21,359,939	23,288,255	47,137,812	55,326,163
Poultry—	Number.	Number.		
Alive	896,039.	858,979	38,779	37,923
	Cwt.	Cwt.		
Dead	246,282	278,573	806,786	955,238
Game—				
Alive	—	—	27,019	43,412
Dead	—	—	62,412	76,115

Bacon.—The imports of bacon in 1913 (4,857,890 cwt.) showed an increase compared with 1912, and almost reached the figures of 1911. Denmark sent 2,334,945 cwt., as compared with 2,318,708 cwt. in 1912, and 2,122,087 cwt. in 1911 ; and in these three years the United States sent 1,803,371 cwt., 1,698,347 cwt., and 1,817,835 cwt., and Canada 243,522 cwt., 387,401 cwt., and 615,807 cwt.

The declared average value was 71*s.* 9*d* per cwt., as compared with 62*s.* 10*d.* in 1912, 59*s.* 5*d* in 1911, and 69*s.* 4*d.* in 1910.

Poultry and Game.—The number of live poultry imported was 858,979 in 1913, valued at £37,923, compared with 896,039 in 1912, valued at £38,779. Dead poultry is chiefly received from Russia, the United States, France, and Austria-Hungary ; the total value in 1913 was an increase compared with the total of the preceding year. The value of the imported live game was £43,412, and of dead game £76,115.

Total Imports of Meat.—Converting the live animals into their equivalent weight of meat and adding the total imports of dead meat of all kinds (excluding poultry and game), it appears that the quantity available, in addition to the home supply, was some 23,383, 000 cwt., as compared with 21,697,000 cwt., in 1912, 25,787,000 cwt. in 1911, and 21,401,000 cwt. in 1910. This was not entirely consumed in this country, as there was a small re-export amounting to 581,428 cwt. in 1913.

The total value credited to the different kinds of live and dead meat, including poultry and game, was £56,744,000, as compared with £49,080,000 in 1912, £49,722,000 in 1911, and £48,879,000 in 1910.

IMPORTS OF DAIRY PRODUCE, MARGARINE, AND EGGS.

Description.	Quantity.		Value.	
	1912.	1913.	1912.	1913.
	Cwt.	Cwt.	£	£
Butter	4,005,159	4,139,022	24,354,193	24,083,621
Margarine . . .	1,352,427	1,518,297	3,514,045	3,917,701
Cheese	2,308,787	2,297,579	7,414,091	7,035,336
Milk, condensed .	1,221,686	1,252,965	2,215,354	2,187,057
	Great hundreds.	Great hundreds.		
Eggs	19,085,052	21,579,950	8,394,524	9,590,602

Butter.—More than three-quarters of the butter supplied to this country from abroad comes from the Continent of Europe, Denmark (1,706,759 cwt.), Russia (751,414 cwt.), France (248,579 cwt.), Sweden (332,331 cwt.), and Holland (153,172 cwt.), being the chief contributors. Almost the whole of the remainder is received from Australia (588,399 cwt.), New Zealand (251,663 cwt.), and Argentina (72,418 cwt.).

The quantity of butter received was above the import of 1912, but below that of 1911; the value was 116*s.* 5*d.* per cwt., as compared with 121*s.* 7*d.* per cwt., in 1912, 114*s.* 4*d.* in 1911, and 108*s.* 2*d*, in 1906, the year in which the maximum amount yet recorded was imported.

Cheese.—The supply of cheese again showed a small decrease. More than half our imported cheese comes from Canada, but the imports from this source decreased from 1,607,064 cwt. in 1910 to 1,473,275 cwt. in 1911, 1,352,570 cwt. in 1912, and to 1,293,768 cwt. in 1913 New Zealand is sending cheese in increasing amount.

Eggs.—The supply of eggs has steadily increased in recent years, viz , from 17,710,431 great hundreds in 1909 to 21,579,950 in 1913. Russia and Denmark are the chief contributors to the trade.

IMPORTS OF GRAIN AND FLOUR.

Description.	Quantity.		Value.	
	1912.	1913	1912.	1913.
	Cwt.	Cwt.	£	£
Wheat	109,572,539	105,918,002	46,445,232	43,860,900
„ meal and flour .	10,189,476	11,978,153	5,518,504	6,347,771
Barley	20,126,294	22,439,548	7,871,581	8,077,214
Oats	18,300,400	18,231,163	6,338,451	5,692,869
Oatmeal	832,218	868,877	602,574	607,761
Maize	43,877,338	49,156,953	13,593,216	13,770,342
„ meal	610,310	491,827	240,827	182,413
Peas	2,574,707	1,978,313	1,291,602	1,006,743
Beans	1,256,741	1,540,405	470,847	568,189
Other corn and meal..	12,956,910	12,791,415	6,123,450	5,413,736
Total	220,296,933	225,394,656	88,496,284	85,527,938

Grain and Meal.—There was some decline in the imports of wheat in 1913. The leading sources of supply were Russia (5,011,100 cwt.), India (18,766,100 cwt.), Canada (21,787,900 cwt.), Argentina (14,796,100 cwt.), United States (34,067,944 cwt.), and Australia (10,126,658 cwt.), the noteworthy features

of the wheat trade in 1913 being a drop in the imports from Russia, Argentina, India and Australia and a very large increase (viz. from 19,973,994 cwt. to 34,067,944 cwt.), in the supplies from the United States.

The receipts of flour were greater than in 1912, chiefly owing to increased imports from the United States and Canada, the two principal countries in this trade. The exports of flour from this latter country to the United Kingdom are steadily increasing.

The imports of barley, after dropping in 1912, rose again in 1913. The principal contributors were Russia (6,105,000 cwt.), Turkey (2,237,100 cwt.), Rumania (1,388,800 cwt.), and the United States (4,438,100 cwt.).

Oats amounting to 18,231,163 cwt. were imported in 1913, this figure being slightly lower than in 1912 and 1911. Russia (2,784,800 cwt.), Argentina (6,401,700 cwt.), Germany (3,422,000 cwt.), and Canada (2,348,000 cwt.) were the chief sources of supply, while the imports from the United States were 1,502,815 cwt.

The supply of maize (49,156,953 cwt.), although larger than in the preceding five years, did not reach the 1907 total, when the imports amounted to 53,379,950 cwt. Compared with 1912 there were decreases in the imports from Russia and Rumania, some rise in the imports from the United States and Canada, and a huge increase from Argentina, viz., from 28,795,830 cwt. in 1912 to 38,854,073 cwt. in 1913.

Fruit and Vegetables.—The quantity of potatoes received was considerably more than in 1912. The imports from all countries, except the Channel Islands, increased in 1913 compared with 1912. The chief countries in this trade are Germany, Holland, France, and the Channel Islands. The other vegetables imported are mainly onions and tomatoes.

With regard to fresh fruit, there was a failing off in the imports of apples, apricots and peaches, cherries, grapes, lemons and strawberries. There were increases in the imports of bananas, currants, gooseberries, nuts, oranges, pears and plums.

Hops were imported to the extent of 262,184 cwt., as against 243,883 cwt. in 1912, and at a lower price.

Wool.—As regards wool, the quantity imported decreased slightly from that of the previous year, but the average price was rather higher, viz., 10½*d.* per lb., compared with 10*d.*, the level at which it stood in 1912. The bulk of the supply came, as usual, from our Colonies and Possessions,

viz., Australia (265,078,422 lb.), New Zealand (181,181,381 lb.), British South Africa (133,224,202 lb.), and India (54,946,749 lb.). Argentina sent 55,455,562 lb. The total receipts were 802,096,772 lb., as compared with 806,855,687 lb. in 1912.

The re-exports of Foreign and Colonial wool were 306,480,308 lb., as against 337,675,029 lb. in 1912, so that the balance of wool (other than home produce) remaining for manufacture in this country was 495,616,000 lb., as compared with 469,181,000 lb. in 1912, 490,307,000 lb. in 1911, and 463,929,000 lb. in 1910.

Soy Beans.—The imports of soy beans into this country were separately shown in the Trade Returns for the first time in 1910, when the comparatively large total of 421,531 tons was imported. Since that year, however, the trade has been rapidly diminishing. In 1911, 222,157 tons were imported and in 1912, 188,760 tons. The imports in 1913 only reached the small figure of 76,452 tons. The aggregate value was £635,747, and the average value per ton about £8 6*s*.

Miscellaneous.—In addition to the agricultural products already mentioned there are some articles of importance which may be referred to as of interest to the agricultural industry. The figures for these are given in the following table :—

MISCELLANEOUS IMPORTS.

Description.	Quantity.		Value.	
	1912.	1913	1912	1913.
	Cwt	Cwt.	£	£
Wood and Timber ..	—	—	28,357,158	33,789,356
Tallow and Stearine..	2,136,472	2,015,802	3,580,104	3,412,664
Hides :				
Dry	676,720	622,748	2,511,303	2,688,843
Wet	939,889	831,084	3,142,399	3,159,215
Manures ·	Tons	Tons.		
Basic Slag .	49,313	51,133	89,174	102,114
Bones, burnt and unburnt	41,203	40,685	217,544	219,637
Guano	14,115	25,548	81,568	149,189
Nitrate of Soda ..	123,580	140,926	1,274,752	1,490,669
Phosphate of Lime and Rock Phosphate . ..	520,267	539,016	840,996	874,166
Oil Seed Cake .	387,702	406,706	2,498,821	2,539,891
Seeds, Clover and	Cwt.	Cwt.		
Grass . ..	288,858	260,751	697,066	623,769
Flowers, fresh ..	—	—	220,863	288,728
	No.	No.		
Horses	12,646	11,876	473,019	458,402

Prices.—Some indication of the range of prices may be gathered from the average declared value of the different articles, but only to an approximate extent, as an increased

importation of a cheaper quality of any article depresses the average value, although no real change in price may have taken place. With this reservation it may be said that the record for the past year shows, on the whole, a decided increase in the prices of meat and live stock, and a decrease in the prices of dairy produce and cereals. The increases per cwt. were as follows :—Cattle, 10*s.* 11*d.* (per head) ; beef, 9*d.* ; mutton, 2*s.* 4*d.* ; pork, 2*s.* 2*d.* ; bacon, 8*s.* 11*d.* ; and the decreases were (per cwt.) : butter, 5*s.* 2*d.* ; cheese, 3*s.* ; wheat, 3*d.* ; maize, 7*d.* ; wheat flour, 3*d.* ; barley, 8*d.* ; and oats, 8*d.* The figures for some of the principal articles are as follows :—

AVERAGE DECLARED VALUES OF AGRICULTURAL PRODUCE IMPORTED.

Description.		1910.	1911.	1912.	1913.
		£ s. d.	£ s d.	£ s. d.	£ s. d.
Cattle ..	Head	18 6 11	18 16 10	20 1 11	20 12 10
Sheep .	,,	1 15 4	1 11 1	1 10 10	1 10 0
Beef, fresh and refrigerated..	Cwt	1 13 6	1 10 3	1 14 2	1 14 11
Mutton, fresh and refrigerated .	,,	1 16 3	1 15 11	1 18 7	2 0 11
Pork, fresh and refrigerated	,,	2 9 11	2 9 6	2 13 1	2 15 3
Bacon .. .	,,	3 9 4	2 19 5	3 2 10	3 11 9
Hams .. .	,,	3 10 3	3 1 4	3 0 7	3 11 9
Butter .	,,	5 13 3	5 14 4	6 1 7	5 16 5
Cheese .	,,	2 15 5	3 0 10	3 4 3	3 1 3
Eggs	Great hundred	0 7 11½	0 8 4	0 8 10	0 8 11
Wool	Lb.	0 0 10¼	0 0 10	0 0 10	0 0 10¼
Wheat .	Cwt.	0 8 4¼	0 7 11	0 8 6	0 8 3
,, flour .	,,	0 11 0¾	0 10 6	0 10 10	0 10 7
Barley .	,,	0 5 10¾	0 6 9	0 7 10	0 7 2
Oats	,,	0 5 6¼	0 5 11	0 6 11	0 6 3
Maize ..	,,	0 5 6¾	0 5 7	0 6 2	0 5 7

Agricultural Exports in 1913.

The value of the agricultural articles of British production and manufacture exported amounts in the aggregate to a considerable sum, although taken individually such articles do not usually represent a very extensive trade. The information, available for the past year, is summarised in the following tables. The various commodities included under the heading of corn, grain, and flour represent a total of £3,564,983, while meat of all kinds, including live cattle for food, bacon, hams, poultry, and game, accounts for £1,239,000. Wool from British flocks was exported to the value of £1,789,648, while hides and undressed skins accounted for £1,889,394.

EXPORTS.

Description.		1912.	1913.
Grain and flour..	£	4,238,880	3,564,983
Meat (including animals for food) ..	£	1,102,582	1,239,000
Wool	lb.	47,134,500	28,662,100
	£	2,359,888	1,789,648
Hides and undressed skins	£	2,027,826	1,889,394
Manures	tons	664,204	706,245
	£	5,289,127	5,769,714
Oil-seed Cake	tons	77,821	53,445
	£	548,648	354,340
Agricultural machinery (prime movers)	£	1,299,919	1,361,195
,, (not prime movers or electrical)	£	1,605,354	1,627,873

Description.		Quantity.		Value.	
		1912.	1913.	1912.	1913.
ANIMALS, LIVING—FOR BREEDING:		Number.	Number.	£	£
Cattle	To United States of America	549	1,199	19,502	43,716
	,, Uruguay	4	178	218	17,620
	,, Argentine Republic	322	1,270	48,086	123,602
	,, Australia	12	53	1,344	6,116
	,, Canada	185	139	13,993	4,771
	,, Other Countries	794	1,741	40,568	78,472
	Total	1,866	4,580	123,711	274,297
Sheep and Lambs.	To Germany	312	541	2,701	5,285
	,, United States of America	129	836	1,148	5,811
	,, Uruguay	58	427	345	4,521
	,, Argentine Republic	185	3,205	3,818	57,887
	,, Australia	8	173	480	4,099
	,, New Zealand	60	123	1,684	2,915
	,, Canada	21	424	50	2,902
	,, Other Countries	724	809	6,076	9,029
	Total	1,497	6,538	16,302	92,449
Swine	To Argentine Republic	—	313	—	4,729
	,, Canada	29	37	290	264
	,, Other Countries	561	1,005	6,023	13,070
	Total	590	1,355	6,313	18,063
HORSES:	To Netherlands	22,218	18,940	328,339	129,628
	,, Belgium	34,078	34,835	445,337	483,695
	,, France	4,709	5,756	211,115	279,899
	,, Other Countries	5,924	9,105	483,812	889,993
	Total	66,929	68,636	1,468,603	1,783,215
ANIMALS OF OTHER KINDS—					
Not for food		65,545	41,313	60,063	62,856

Three items of importance, viz., manures, cakes, and agricultural machinery, are included in the table, though they are not agricultural products. In the case of manures, 706,245 tons were sent from these shores, representing a value of £5,769,714; nearly one-half of this, viz., 324,704 tons, was sulphate of ammonia, while the balance was made up of 63,503 tons of superphosphate, 165,100 tons of basic slag, and 152,938 tons of other kinds of artificial manures.

As regards oil-seed cake, the exports of this feeding stuff have steadily declined from 175,422 tons in 1910 to 53,445 tons in 1913.

Perhaps the most-interesting item in the export trade, from an agricultural point of view, is that which shows the sales of breeding animals to the Colonies and foreign countries. In the table on p. 892 the particulars are given for the past two years. The year 1913 witnessed a great expansion in this export trade in animals. The values of exports of cattle, sheep and lambs, and swine, to other countries, for breeding purposes were the largest since separate records for such animals were first kept, in 1908, and were nearly one-half again the value in the next highest year, 1909. The increases in the exports of cattle were mainly to Argentina and the United States. Compared with 1912, however, the trade was in slightly less valuable animals, the average value per head of the cattle being £60 against £66 in 1912. The value per head in 1911 was £39.

The exports of sheep to all individual countries were larger than in 1912, the most notable feature being an increase in the sales to Argentina from £3,818 in 1912 to £57,887 in 1913. The value per head exported to all countries increased from £11 in 1912 to £14 in 1913.

In comparing the years 1912 and 1913, however, it must be borne in mind that owing to the outbreaks of foot-and-mouth disease in this country in the former year the exports were considerably below the normal.

The value of the swine exported in 1913 was double that of the next highest year, 1910. Swine were sent from this country to Argentina in 1913 for the first time since 1910.

Horses represent the largest item in this export trade, and both the total number and value in the past year are the largest yet recorded.

A sample of wheat, submitted to the Board for examination, has been thoroughly investigated at Kew. It was stated to be part of some seed wheat that had produced only half a crop, and that on testing had not germinated above fifty per cent. The sample was good, bright, plump and dry, but in some instances the space occupied by the embryo was a little depressed or shrunken, and in such cases a section showed that the embryo had to some extent contracted beyond the normal condition.

Bad Germination of Wheat Seed.

An experiment was made in germinating the wheat (sent as loose grain) under specially favourable conditions on damp blotting paper in a greenhouse with a temperature of 65° to 70° F. The result with threshed wheat was a germination of 81 per cent. of the grains, and with a second lot, in which the "seeds" were first slightly cut, 93 per cent. This shows that very few, if any, seeds in the sample were actually dead, but many proved to be sluggish in germinating, and some of them would probably have died off later. The percentage of successful germinations in a field-sowing would, no doubt, be very much lower.

Another sample of grains, taken from the ear, was placed between sheets of damp cotton wool at a temperature averaging 60° F., and in this case 43 was the highest percentage of germination obtained.

Examination of the grain still in the ear showed that the chaff was more or less blackened by a fungus which, on examination, proved to be *Cladosporium graminum*, Corda. This fungus has long been known as a parasite on cereals and various wild grasses throughout Europe, and, under the name of *Scolecotrichum graminum*, Fuckel, has been more than once recorded by Carruthers as doing harm to cereals in this country. The same fungus appears to be known as a parasite on cereals in the United States, and, judging from descriptions, *C. graminum* apparently occurs wherever cereals are cultivated.

The fungus occurs on the leaves, leaf-sheaths, and ears. As a rule but little injury results from the presence of the fungus on the leaves, but when the ear is attacked much loss may result. In extreme cases the ear is more or less completely blackened by the presence of the fungus on the chaff, and the grain is shrivelled. This occurs when the ear is attacked when quite young, the mycelium of the fungus extending quickly and permeating every part, the consequence being that in such cases the ear is arrested in its growth. In other

instances the chaff only is attacked, as indicated by the presence of a blackish or olive-coloured stain. This condition is practically always present every season, more especially in the case of wheat. In the case under consideration, the severity of the attack is intermediate between the two extremes described above. The chaff was more or less discoloured and blackened by the fungus, as shown in the illustration, and in addition the mycelium had entered into the pericarp or outer covering of the grain, but only to a limited extent, and had not reached the embryo, and hence the grain continued to grow, and reached maturity in an apparently uninjured condition. An examination of sections of the pericarp of the grains that did not germinate, or germinated but feebly and soon died, showed the presence of mycelium in every instance; the mycelium could be readily traced in the tissue, owing to its pale olive colour. Sections of grains showing mycelium in the pericarp were placed in hanging drops, and at the expiration of four days the mycelium resumed active growth and had passed into the embryo. This experiment was repeated several times, and always with the same result. An examination of sections of grains that had failed to germinate, or of which the seedling had perished soon after germination, showed the embryo to be invariably permeated by mycelium. No mycelium was found in the pericarp of the seeds that germinated and continued to grow vigorously.

In the present instance the failure to germinate, or at all events, to produce a healthy, vigorous plant, depends to a very great extent, if not altogether, on the presence of dormant mycelium in the pericarp or outer covering of the grain. When such seed is placed under favourable conditions for germination, the mycelium also commences active growth, and extends to the embryo either before or shortly after it emerges from the grain. It is well known that even fragments of the mycelium of *Cladosporium* will resume active growth when placed under favourable conditions, even after a long period of desiccation, hence there is no difficulty in understanding the infection of the embryo by mycelium that had remained for a considerable period of time in a dry and passive condition in the pericarp of the grain. The severity of the attack is probably much influenced by weather conditions, and in bad cases every portion of the ear is attacked. The mycelium may often be seen invading hairs present on the chaff as shown in Figure 9 of the plate. Figure 8 shows a branch of mycelium passing along the lumen or cavity in one of the bristle-like

hairs forming the "beard." This suggests that the mycelium possesses the power of dissolving the cell-wall to some extent, as the mycelium is much wider than the original cavity along which it has grown. In addition to the ordinary mycelium present in the tissues, numerous minute micro-sclerotia are formed which act as resting-spores, remaining in a passive condition in the chaff or grain during the winter, and germinating the following spring. The spores on germination do not infect the host directly, but produce very minute secondary conidia which infect the living plant. These secondary conidia, which are produced in chains, once constituted the form genus called *Hormodendron*, and so long as the fungus is living as an active parasite the *Hormodendron* form of fruit alone is produced, and is responsible for the rapid spread of the disease. When the vitality of the host-plant begins to wane, the better known *Cladosporium* form is produced, the spores and micro-sclerotia of which serve to tide the fungus over that period when no living host-plants are present, and to furnish the secondary or *Hormodendron* conidia, which are capable of infecting living grasses.

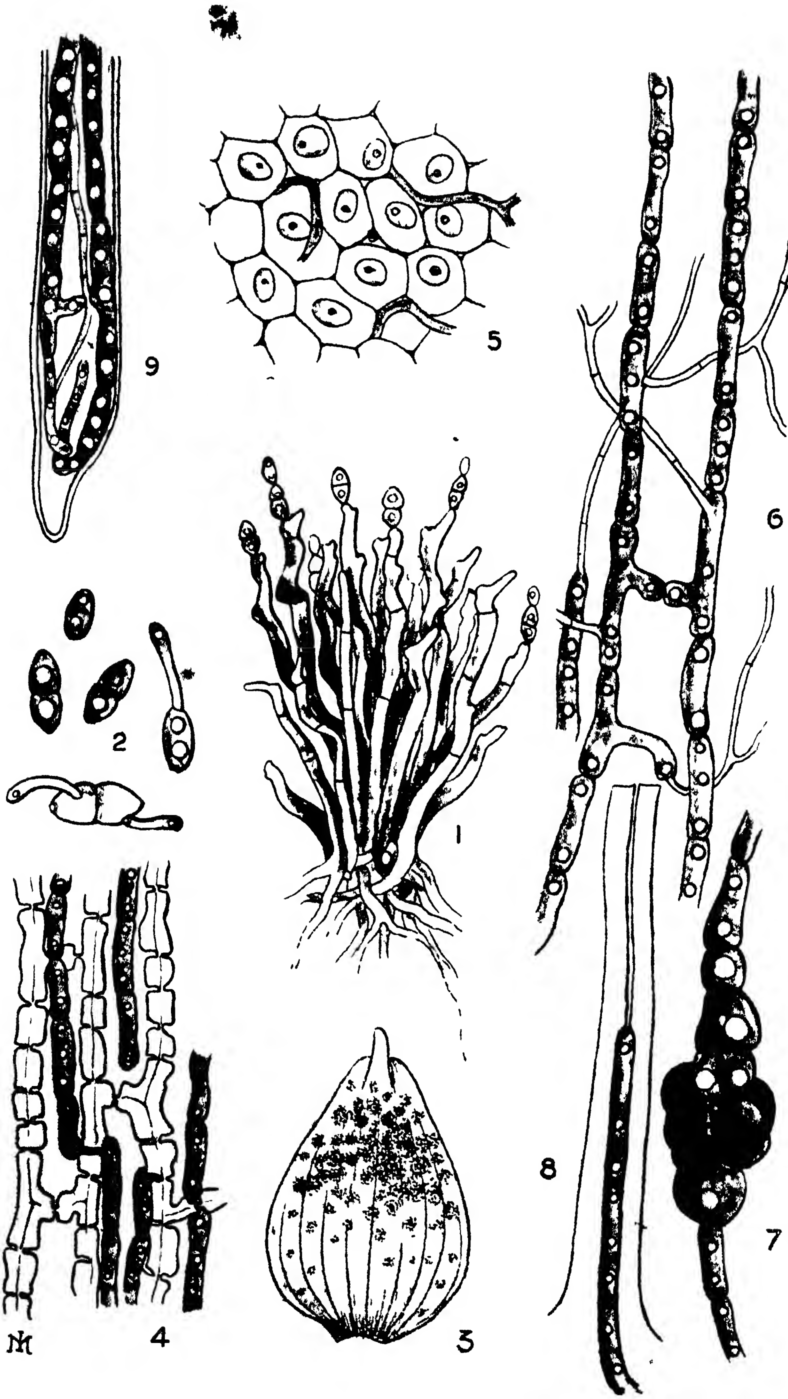
DESCRIPTION OF THE PLATE FIGURES.

1. *Cladosporium graminum*, Corda, × 400.
2. Spores of same, × 600
3. Flowering glume or chaff of wheat from a ripe ear, blackened by the presence of *Cladosporium graminum*, Corda, × 8
4. Mycelium in the pericarp of a wheat grain, × 600
5. Mycelium present in the embryo after germination had commenced, × 600
6. Mycelium in the pericarp of a wheat grain, commencing to grow and forming slender colourless hyphæ which entered the embryo and killed it, × 600
7. Micro-sclerotium formed in the tissue of flowering glume, × 600.
8. A branch of mycelium penetrating the cavity of one of the stiff hairs forming the "beard," × 600
9. Mycelium growing inside a hair from a chaff-scale, × 600

Effect of Smoke on Stock Farming.

Smoke may have an injurious influence on live stock mainly in two ways. In the first place the efficiency of the animals' organs may be impaired by the direct respiration of smoky atmosphere, and in the second place animals may suffer indirectly through the consumption of damaged food or through the food being rendered unpalatable.

In connection with the investigations which are being carried out by the Agricultural Department of Leeds Univer-



Disease of Wheat due to *Cladosporium graminum*, Corda.
(For description see text, p. 896).

sity on the effect of atmospheric impurities on vegetation, enquiries have been addressed to farmers in the smoke-infested districts round Leeds as to the effect of ordinary town smoke on stock farming, and the results of these enquiries have been very kindly communicated to the Board by Mr. D. W. Steuart, B.Sc., of Leeds University.

Horses.—As regards horses, the smoke seems especially injurious to foals; in one case, a farmer who had five foals in twenty years, stated that none throve after the first year. This was confirmed by a second farmer who reported that the young horses did very well so long as they were with their dams, but that when they had to live on grass they lost flesh and grew weak. The injurious effect on the nutritive value of the grass was confirmed by further reports to the effect that horses in a smoky district cost distinctly more for their keep than elsewhere.

Cattle.—The influence of the smoky atmosphere is manifested in the same directions with cattle as in the case of horses. There is a difficulty in rearing calves, which do not seem to be able to thrive on "smoky" grass. Cows require extra care and feeding, and even then it would appear that they cannot be properly fattened in summer. Although reports as to the milk yield varied, the general consensus of opinion was that it was injuriously affected With regard to the effect on breeding stock, one report stated that it was advisable to change these animals every few years as the smoke caused them to be more liable to illnesses. A further disadvantage lies in the injury to the coats of animals intended for sale or show purposes.

Sheep.—Sheep are rarely seen in the more smoky districts round Leeds, and there is very little doubt that, although other causes operate, this is to be ascribed in part to the injurious effects of the smoke, not only on the sheep and grass, but also on the state of the hedges, hawthorn being particularly susceptible to smoke injury. In addition to the difficulties of rearing and fattening stock, the depreciation in the market value of the animals as a result of the blackening of the wool by smoke has to be taken into account. It was reported that farmers were very averse to wintering their sheep in these smoky districts.

A veterinary surgeon's report stated that smoke was certainly detrimental to the growth of farm animals, all young stock being affected by it; post mortem examination often showed the effects of both ingestion and inhalation of matter carried in smoke.

The harmful effect of smoky atmosphere on live stock seems to be cumulative from generation to generation.

An Agricultural School in Austria.

The "Francisco Josephinum" Agricultural School at Mödling, in Austria, is an agricultural intermediate school. The pupils must have had some general education and possess some practical knowledge before being received into the school, while under the systematic curriculum followed at the school their general education is continued and a training is given in technical subjects, with the object of fitting the pupils, on their subsequently obtaining adequate practical experience in agriculture, to manage their own land with success, whether as tenants or medium or large landowners, or to become teachers in the lower agricultural schools.

NUMBER OF LECTURE HOURS.

Subject.	Number of hours per week in the six terms.					
	1st.	2nd.	3rd.	4th.	5th.	6th.
Arithmetic and algebra	4	—	—	—	—	—
Geometry	—	3	2	—	—	—
Physics and meteorology	4	3	—	—	—	—
General chemistry	6	4	—	—	—	—
Agricultural chemistry	—	—	3	3	—	—
Geology	—	3	—	—	—	—
Botany	4	4	—	—	—	—
Physiology of plants, especially cultivated crops	—	—	2	—	—	—
General zoology	2	—	—	—	—	—
Agricultural zoology	—	3	—	—	—	—
Anatomy and physiology of domestic animals	—	—	2	—	—	—
Political economy	—	—	2	2	—	—
Cultivation of farm crops	—	—	5	5	2	2
Cultivation of fruit, vines, and vegetables	—	—	—	—	2	2
Animal breeding	—	—	5	5	—	—
Agricultural machinery and implements	—	—	2	2	—	—
Engineering and improvements	—	—	—	—	3	2
Technology of agricultural chemistry	—	—	—	—	3	3
Economics and taxation	—	—	—	—	6	3
Agricultural book-keeping	—	—	—	—	—	3
Forestry	—	—	—	—	2	2
Dairying	—	—	—	—	—	2
Surveying	—	—	—	2	—	—
Building construction	—	—	—	—	3	—
Farriery and veterinary subjects	—	—	—	—	2	—
Agricultural law	—	—	—	—	2	2
" statistics	—	—	—	—	—	2

The school was founded in 1869 by the Agricultural Union of Mödling. It is controlled by the Austrian Ministry of Agriculture, the Agricultural Committee for the province of Lower Austria, the Government of the province of Lower Austria, and the Agricultural Union of Mödling.

The course extends normally over three years, but is shortened to two in the case of students having received an education superior to that of the majority of pupils. A gardening school is attached to the school proper.

The school year consists of two terms—a winter term from the middle of September until the middle of February, and a summer term from the middle of February until the middle of July.

Pupils must be at least in their sixteenth year. They must satisfy the school authorities as to their general education, and they must either have had at least one year's practical experience on a large estate, or must undertake to spend their holidays while at the school on a well-conducted estate.

Instruction in Scripture and the German language and literature is given throughout the six terms, and in history and geography throughout the first four terms. The number of hours per week given to lectures in other subjects in the six terms is given in the table on p. 898.

Demonstrations and practical work in botany, zoology, and the use of agricultural machinery are included in the time allowed for lectures in these or kindred subjects.

The number of hours per week given to demonstrations and practical work in other subjects is as follows :—

Subject.	Number of hours per week in the six terms.					
	1st.	2nd.	3rd.	4th.	5th.	6th.
Chemistry	—	3	2	—	—	—
Cultivation of crops	—	—	2	3	—	—
Fruit growing	—	—	—	—	—	1
Animal anatomy and breeding	—	—	3	3	—	—
Technological work	—	—	—	—	2	2
Book-keeping	—	—	—	—	—	2
Farriery and veterinary subjects	—	—	—	—	1	—
Surveying	—	—	—	2	—	—
Building construction ..	—	—	—	2	2	—

The fields in which the demonstrations and practical work are carried on are near the school, but excursions are also undertaken in amplification of the theoretical work in some

subjects. The school possesses a fully-equipped laboratory with up-to-date apparatus.

The gardening school was founded in 1871. Special attention is given to practical and theoretical instruction in the cultivation of the vine, fruit, and vegetables. The course is of one year's duration.

The fees for the ordinary course are £4 3s. per term; for the use of library and laboratory, £1 per term; for a special course in brewing, £6 5s. per term; and for the course in gardening, £2 1s. per term. Board and lodging at the school costs £21 per term. There are six scholarships for agriculturists of the value of £21 per annum, two of the value of £25, and one of the value of £3 10s. In addition, the Ministry of Agriculture gives grants to students of £6, £5, and £4 per annum. There are two scholarships for gardeners of the value of £21 per annum, three of £12 10s., and aids similar to those for agriculturists are given by the Ministry of Agriculture to gardening students.

There were 134 students at the school in 1912-13—43 first year, 43 second year, 38 third year, and 10 gardening students. The ages varied from 15 to 24, the average being 18. With regard to the profession of the students' parents, 37 were landowners, 4 tenant farmers, 14 agricultural or forestry officials, 22 commercial men or manufacturers, 28 officials other than those for agriculture or forestry, and 29 were of other professions.

The receipts of the school in the financial year January 1st, 1912, to December 31st, 1912, included £1,416 in grants, viz., £833 from the Ministry of Agriculture, £166 from the Provincial Government of Lower Austria, and £417 from the Agricultural Committee of Lower Austria, fees from students amounted to £1,328; and there were further receipts from the sale of garden and brewing produce. A special grant was received during the year from the Ministry of Agriculture in respect of new buildings.

Destruction of Bracken.

In an article on this subject which appeared in this *Journal* for October, 1911, p. 568, the methods suggested for eradicating bracken were liming, close grazing, and trampling by cattle, and cutting. With regard to the last method reference was made to experiments by Lt.-Col. Ferguson-Buchanan, in which clean cutting with scythe and hook was found to be more effective than any other method (the bracken

being exterminated from 500 to 600 acres at a cost of about £350); and to experiments by Mr. S. Millar, in which 200 acres covered with bracken were turned into good sheep pasture at a cost of £190, by cutting with a tool consisting of a light wooden handle, 4 feet long, bearing at the end a flat curved piece of iron sharpened on both edges; this tool cut the young bracken very easily on both swings, and the workmen did not require to bend. The method of eradication by beating down with sticks was also mentioned, but was stated to be expensive owing to the time taken.

The Board have received a communication from Mr. Munro Ferguson, M.P., of Raith, Kirkcaldy, with reference to the destruction of bracken on pasture land. Mr. Munro Ferguson believes that a great deal of money is wasted by the methods of cutting hitherto employed, the use of a scythe for the destruction of bracken being generally a mistake. He states that bracken can be most economically dealt with by the use of switches prepared by twisting a piece of fencing wire at the end of a stick. Boys can then be employed, under the supervision of a man, to switch the shoots at the stage when they are most readily broken. The need for repeated treatment in the first year is emphasised, it being stated that the bracken will have disappeared after the third year.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

MANURES.

Sulphur and Iron Pyrites as Manures (*Journal d'Agriculture Pratique*, November 26th, 1913)—Some experiments have been recently carried out by MM. Vermorel and Danthony, in France, to test the value of these substances as manures. Pots containing soil from which the organic matter had been carefully removed were used In one case nitrate of soda, and in the other dried blood was mixed with sulphur before being applied. The sulphur, which was applied at the rate of both 45 and 90 lb. per acre, was either mixed with the soil or given as a top dressing. Wheat and haricot beans were sown, and great care was taken to ensure that the conditions for each pot were exactly similar. Compared with the result obtained from the pots to which no sulphur had been applied, there was practically no increase in yield when the

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

sulphur was applied with the nitrate of soda. When the organic manure was used increased yields of 30 per cent. in the case of wheat and 60 per cent. in the case of haricots were obtained. It was found that sulphur gave the best results when mixed with the soil.

An experiment was then made to ascertain if iron pyrites, which is less costly than sulphur, would produce the same effect. Pyrites containing 50 per cent. sulphur was employed at the rate of 90 and 180 lb. per acre respectively under the same conditions as with the pure sulphur. As with the first experiment, the result showed that the increased yield when nitrate of soda was used was practically nil, but with the organic manure increases of 40 per cent. of wheat and 50 per cent of haricot beans were obtained.

FIELD CROPS.

Good Seed Potatoes and how to produce them (*U S Dept. of Agric., Farmers' Bull*, No. 533) —In this review of potato culture, it is pointed out that farmers in the United States are practically at the same point in regard to yield per acre as were their forefathers. In the five years, 1868-1872, the average yield per acre was only slightly less than that in the like period, 1908-1912, and for the years 1901 to 1910 inclusive, was less than half that of Germany and Great Britain.

Of the many causes operating to produce a low average yield in America, the use of poor "seed" is thought to be an important one. In the first place, too little attention is paid to the purity of the stock; furthermore, the custom of planting small tubers is said to be dangerous, as tending to the planting of the produce of potatoes suffering from "curly dwarf" (leaf-curl). The use of immature seed is advised, and growers are also recommended to grow, for seed, plots of specially selected tubers. It is believed that the average potato production of the United States would be materially increased if a more liberal allowance of seed was planted; at present this is, on the average, about one-third of the weight per acre planted in the United Kingdom.

LIVE STOCK AND FEEDING STUFFS.

Feeding Experiments with Cattle and Sheep (*Northumberland C C Educ. Com., Cockle Park Expt. Sta, Bull.* 20).—This bulletin gives records of some of the feeding trials conducted at Cockle Park from 1902–1912, and also accounts of feeding experiments carried out in 1912–13, summaries of which are given below:

Feeding Bullocks and Heifers in Boxes and in Stalls.—Twenty-four cattle, nearly all blue-greys about 18 months old, were placed in four lots, as follows:—

Lot I —6 bullocks in boxes.
Lot II.—6 bullocks in stalls.
Lot III.—6 heifers in boxes.
Lot IV.—6 heifers in stalls.

Each animal received the following daily ration per 1,000 lb. live weight:—56 lb swedes, 10 lb. meadow hay, 10 lb. oat straw, 4 lb. soy bean cake, 2 lb. Bombay cotton cake. The trials commenced on November 18th, and lasted for three months. The results of the experiment are given in the following table:—

	Lot I.	Lot II.	Lot III.	Lot IV.
	cwt. q. lb	cwt. q. lb.	cwt. q. lb.	cwt. q. lb.
Average F.L.W.* of animals at beginning of experiment ..	8 1 0	8 0 14	7 1 23	7 1 6
Total gain in F.L.W. per animal in 12 weeks	*1 1 15*	*1 0 6*	*1 1 0*	*0 3 25*
Average increase in F.L.W. per animal per week	12.9 lb	9 84 lb	11 66 lb.	9 08 lb.
Average value of each animal—	*£ s. d.*	*£ s. d.*	*£ s d.*	*£ s. d.*
At beginning of experiment at 37s. per cwt.	15 5 3	15 0 8	13 15 10	13 10 3
At end of experiment at 42s. 5d. per cwt.	20 8 6	19 9 5	18 9 4	17 11 2
Average increase in value per animal	*5 3 3*	*4 8 9*	*4 13 6*	*4 0 11*
Cost of food during 3 months.	4 0 3	4 0 3	4 0 3	4 0 3
Difference—*Gain,* less other expenses	*1 3 0*	*0 8 6*	*0 13 3*	*0 0 8*

* F L W =fasted live weight

In order to ascertain the effect of the addition of linseed cake to the foregoing ration, three of the six cattle in each lot received during the second week of the fourth month 1 lb. of linseed cake per head daily, which was gradually increased to 2 lb per head daily by the end of the fourth week. The other half of each lot of cattle received no additional food. The results were as follows :—

	Average gains per head.	
	Lot A. Receiving linseed cake.	Lot B. Not receiving linseed cake.
	lb	lb.
3 bullocks in boxes	56	37
3 bullocks in stalls	34	45
3 heifers in boxes	42	42
3 heifers in stalls	41	41
Average	*43¼*	*41¼*

The amount of linseed cake consumed per head by Lot A was 31½ lb., costing *2s. 5d*, whereas the average increase in live weight which resulted from feeding with linseed cake was only 2 lb., having a money value of *9d.* From the result of this experiment it would appear that supplementary food to a sufficient and well balanced ration is not likely to give a return, and that the common practice of feeding cake more heavily towards the close of the fattening period is not economical.

Systems of Wintering Stirks.—This experiment was commenced on December 6th, in order to compare (1) the results of wintering young cattle under practically open-air conditions and under considerably

more confined conditions, and (2) the feeding value of swedes and of yellow turnips.

Twenty-three stirks having an average weight of 502 lb. were divided into three lots. Lot I. were wintered in Broomy Hill pasture field where they had the use of a shelter shed. Lots II. and III. were fed in boxes. The amounts of roots in each ration contained the same weight of dry matter. The daily rations per head were:—

Lot I.	Lot II.	Lot III.
9 lb. Meadow hay.	25 lb. Swedes.	33½ lb. Yellow turnips.
1 lb. Bombay cotton cake.	6 lb. Meadow hay.	6 lb. Meadow hay.
1 lb. Soy bean cake.	1¾ lb. Soy bean cake.	1¾ lb. Soy bean cake.

The average weekly gains per head were: Lot I. 1.86 lb., Lot II. 6.3 lb., Lot III. 6.62 lb. Although the animals in Lot I. made the smallest increase in live weight during the winter, a firm of valuers placed a higher average value on them (£11) than on those of Lot II. (£10 10s.) or Lot III. (£10 12s. 6d.). All the cattle were kept as stores on Hanging Leaves pasture fields during the following summer, when the following weekly gains were made: Lot I. 15.3 lb., Lot II. 15 lb., and Lot III. 13.8 lb It is concluded that young cattle from six to twelve months old can be wintered with excellent results on pasture if they have access to a shelter shed and receive suitable additional food to the pasture.

Sheep Feeding Experiments.—These experiments were conducted in order (1) to compare the feeding values of rations (*a*) containing swedes, (*b*) containing yellow turnips, (*c*) containing no roots; (2) to compare indoor with outdoor feeding.

It was found that the sheep receiving swedes made slightly better gains than those receiving yellow turnips, and that indoor was superior to outdoor feeding

Cost of Rearing and Feeding Blue-Grey Cattle.—The calves are bred from Galloway cows by a White Shorthorn bull The cows are at pasture all the year round. They commence calving early in April and suckle their calves, which are weaned about the end of October, kept in store condition during the first winter and second summer of their lives and sold fat at the end of their second winter.

The following is a summary of the treatment given and approximate costs, which are based on the average prices for seven years ending 1912:

CALVES BORN IN APRIL.

		£	s.	d.
I.—Cost of cow for one year and of calf from April till the end of October—				
Hay for 4 winter months, 8 lb. daily = 8½ cwt. at 50s. per ton	21/3			
Pasturage of cow and calf for year	66/–			
Value of calf at birth, say..	40/–	6	7	3
II.—Cost of stirks during first winter, 24 weeks— Ration per head (average live weight 500 lb)—				
25 lb. swedes (10s. per ton) .. .. } daily				
6 lb. meadow hay (50s. per ton) .. } with				
1¾ lb. soy bean cake (135s. per ton) .. } grass		2	19	0
III.—Cost during second summer, 28 weeks—				
Grazing at 1s. 6d. per week		2	2	0

IV.—Cost during second winter till fat, say 20 weeks—

Ration per head (average live weight 1,000 lb.)—		£ s. d.
56 lb. swedes (10s. per ton)	daily, costing 6/8 a week	
10 lb. meadow hay (50s. per ton ..		
10 lb. oat straw (35s. per ton) ..		
2 lb. Bombay cotton cake (95s. per ton)		
4 lb. soy bean cake (135s. per ton) ..		6 13 4
Total cost		£18 1 7

It is noted that since the cattle are under experiment during the first winter, the second summer, and the second winter, economical rearing cannot be practised to the fullest extent. The following table gives the weight of these blue-grey cattle and their approximate average values at various stages for seven years ending 1912 :—

——	Live Weight.	Value per cwt.	Value per Animal.
		£ s. d.	£ s. d.
At beginning of first winter	4 cwt.	1 12 6	6 10 0
At end of first winter .. .	5¼ ,,	1 16 0	9 9 0
At beginning of second winter ..	7¾ ,,	1 12 0	12 8 0
At end of second winter	10 ,,	1 18 0	19 0 0

DAIRYING.

Cost of Food in the Production of Milk (*The University of Leeds and the Yorkshire Council for Agric. Education, Bull. No.* 88 ; *Charles Crowther, M. A., Ph.D.*)—During the twelve months from April 1st, 1911, to March 31st, 1912, a systematic investigation respecting the yield and quality of milk produced by the cows on a number of farms in the North Riding of Yorkshire was conducted. This work was continued during the following year, and the results obtained are dealt with in this bulletin. Each farm was visited once a fortnight for the purpose of weighing, sampling and testing the morning's and evening's milk of each cow; the nature and amount of the food supplied to the cows was also noted.

Nine herds, comprising 270 cows, chiefly non-pedigree Shorthorns, came into the tests. One herd consisted of pure-bred Guernseys, another of pure-bred Shorthorns, while a third contained both Guernseys and pure-bred Shorthorns. It was found as in the previous year that there were marked differences between the averages for the different herds.

The highest average yield was 827, and the lowest 555 gallons. The average yield for 109 cows whose complete records were obtained was 651 gallons. Valuing the milk at 8d. per gallon, it was found that the differences between the values of the milk produced during the twelve months by the best cow and the worst cow of the several herds varied from £9 13s. to £30 1s.

The yield of more than one-half of the total number of cows in each year was found to fall between 500 and 800 gallons. The range of variation in the total cost of feeding on the different farms was from

£14–£20 per cow, the corresponding limits for the preceding year being £15–£23. The estimated cost of food per gallon of milk varied from 5.0 to 7.9 pence, a range of variation which agrees closely with that found in the previous year, 5.2 to 8.7 pence. Results were obtained which indicate that a high total expenditure in food need not mean a high cost per gallon of milk. It is suggested, however, that much greater care and skill is required in the selection, feeding and *milking* of the cows. The estimated average cost of the different classes of foods per cow per annum for the various herds was:—Pasture and green fodder, £4 10*s.* 2*d.*; hay, £3 19*s.* 3*d.*; straw, 16*s.* 1*d.*; roots, £1 15*s.* 10*d.*; cakes, &c., £6 9*s* 10*d.*

It was observed, as in the previous year, that a perceptible falling-off in the average percentage of fat took place when the yield exceeded 700 gallons. It is stated, however, that it would be dangerous to base any general conclusions upon the data obtained, as, even with the two years' records combined, the number of cows in each group was far too small to give a trustworthy average. The percentage of fat varied in the morning milk from 2.6 per cent. to 6.1 per cent., and in the evening milk from 3 0 per cent. to 6.1 per cent. Excluding the herd of Guernseys, the highest value recorded for the mixed milk was 5.3 per cent. It was found that the greater the inequality between the night and day intervals the greater was the difference between the average percentage of fat in the milk obtained at the two milkings In only one instance did the evening milk contain less than 3 per cent of fat, whilst in the whole day's produce this never occurred.

Conformation of Cows and Milk Yield.—The question of the relation, if any, between the conformation and milk yield of a cow has lately aroused a good deal of discussion, and in Holland in particular much attention has been given to the problem. An investigation made in 1911 by H. M. Kroon and C. J. Rab pointed to the conclusion that no such relationship exists. The methods of these investigators were called in question by another authority, H. M Overbosch, and the matter was referred to a third party, C. F. Van Oxyen, who applied Overbosch's method to Kroon and Rab's figures, and obtained a confirmation of the latter's findings.

Further inquiry has been made into the subject by J. Reimers, an agricultural teacher at Wageningen, and his conclusions were summarised in the *Mitt. der Deut. Landw. Gesell.*, for April 26th, 1913. The data investigated by him were taken from the Friesian Cattle Herd Book, and had reference to three hundred animals, from 2½ to 3 years old. With regard to the statistical methods adopted, it may be explained that he divided the animals with milk yields between 4,400 lb. and 8,800 lb into five classes, and attempted to correlate the yields with the various features of the conformation. He also divided the animals into classes according to their body measurements, and attempted to correlate these with the milk yields.

The investigators' findings, when summarised, were, generally, to the effect that no relationship existed between conformation and milk yield. His conclusions were as follows:—

The milk yield increases slightly with increasing *length of body* until the latter reaches a certain point, after which there appears to be a slight decrease in the yield. Abnormal length of body apparently has the effect of lowering the milk secretion.

The milk yield increases with increasing *height of crupper;* but the increase can by no means be called regular, and a strong connection between the two factors could not be established.

Animals with small or with very deep breasts appear to give a smaller yield than animals which are normal in this respect, but the difference was too slight to make the deduction of practical value.

There is no regular relationship between milk yield and *length of hindquarters*, or *width between haunches*, or *breadth of pelvis* Animals with normal breadth of pelvis give more milk than those with larger or smaller breadth of pelvis, but the difference is not important.

The system followed by herd book inspectors, in awarding points for conformation, was also taken as a basis of comparison. No more success was met with in this direction, except, of course, in the case of points for udder, teats, milk veins, and similar indications of good milk yield. In the Friesian Herd Book as many as 12 points are awarded for shape of hindquarters, but no relation between this and the milk yield could be traced. Further, the best milkers had the worst thighs (although there was no regular connection between this and the yield).

Hegelund Method of Milking (*Biedermann's Zentralblatt, October,* 1913). —Numerous experiments have been undertaken from time to time to test the efficacy of the Hegelund method of milking, for which it is claimed that with a complete emptying of the udder an increased yield of both fat and milk is obtained. The results of the experiments had been conflicting, and it seemed that any advantages which might be ascribed to the Hegelund method were due chiefly to the fact that the cows had not been thoroughly milked previous to its introduction.

An experiment was conducted during the winter of 1911–12 on the estate of the Norwegian Agricultural High School at Aas in order to throw some light on this point Eight cows divided into pairs were used. For the first 25 days the cows were all milked in the ordinary way, but as carefully and thoroughly as possible. The actual test for a period of 55 days was then undertaken; one cow of each pair was milked according to the Hegelund method and the other in the usual way For a further period of 25 days the cows were again all milked on the ordinary system. During the whole period each cow was milked by the same milker, and the milk was weighed and tested daily.

The result showed that when the ordinary system of milking is carried out thoroughly the Hegelund method has practically no advantage, especially when it is considered that it takes considerably longer.

DISEASES OF LIVE STOCK.

Rearing of Calves from Tuberculous Parents (*R.A S.E*, *Proc. at Monthly Council, December* 10*th,* 1913).—Experiments have been carried out at Woburn for the purpose of demonstrating that by means of isolation it is possible to rear healthy stock from tuberculous parents. Arrangements were made with several owners to allow their cows to be submitted to the tuberculin test, and for any selected to be placed at the disposal of the experimenters. As soon as possible after the test had been carried out the selected reacting cows were sent to the experimental farm at Woburn and kept there until they had calved and cleansed, after which they were returned to their owners.

To guard against the calves being infected by their dams, each cow at the time of calving was tied up, and as soon as the calf was born it was moved into a building that had not previously been used for cattle, where it was rubbed dry. As soon as possible thereafter it was removed by cart to specially prepared calf rearing premises, a mile distant. Further, the man in charge of the calves was kept entirely for this work and had no contact with other cattle.

The buildings in which the calves were reared had been to a large extent reconstructed, provided with a new floor, cleansed, disinfected and whitewashed. Before the milk on which the calves were fed was used it was raised to a temperature of not less than 190° Fah. by immersing the vessels containing it in water, which was kept boiling.

When the milk diet was stopped the calves were kept in two fields which were reserved exclusively for their use, and they were never allowed to come into contact with other animals, with the exception of the bull which was put with them to serve the heifers. This bull had passed the tuberculin test before he was brought to the place, and after arrival, he was again tested, with the same result.

The calves so reared were slaughtered and submitted to post-mortem examination and no evidence of tuberculosis was found in any of the animals, so that these experiments may be held to have demonstrated that by means of isolation it is possible to rear healthy stock from tuberculous parents.

Incidentally the experiments added further testimony to the value of the tuberculin test, for even on the assumption that the test is quite untrustworthy there did not appear to be any reasonable explanation of the fact that (with one exception) none of the calves reacted, while among 116 apparently healthy cows 32 reacted distinctly. In the case of the calf that formed the exception the rise in temperature during the test was accidental, *i.e.*, it was caused by illness and not by the tuberculin.

Husk or Hoose in Calves (*Journ Dept of Agric. for Ireland, October*, 1913).—"Husk" or "Hoose" is a disease which affects calves and sometimes lambs, and is caused by small thread-like worms in the windpipe. The chief sympton is a hard husky cough. The animal becomes dull and listless, and rapidly loses condition, and the skin becomes dry and hard. These symptoms are usually noticeable in August, September and October, and unless remedial measures are promptly adopted death may result. The Department have found the following treatment effective if adopted as soon as the symptoms of husk are observed :—

Give once daily to each affected calf, according to size and age, from one to two tablespoonfuls of a mixture composed of :—

1 drachm oil of cloves.
8 oz. spirits of turpentine.
24 oz. linseed oil.

The dose should be given alone and before the animal is fed, and may be repeated daily for four or five days.

The following preventive measures are suggested :—

(1) Reserve the driest field and the finest and most fresh herbage for calves.

(2) Apply either a medium dressing of lime or 8–10 cwt. of salt per acre on land where calves are subject to the disease.

WEEDS AND PLANT PESTS.

Wart Disease of Potatoes (*Report on Expts. conducted at Blakeley Hill, Stanton, Shrewsbury, High Hatton, Shrewsbury, and Harper Adams' Agric. Coll., G. T. Malthouse.*)—The work done consisted of the re-testing for resistance to wart disease of varieties previously found to be immune, and tests of varieties of potatoes not grown before and also other species of *Solanum*. A number of crosses were also made for the purpose of raising new resistant varieties. A stock of 29 crosses as well as six selfed varieties was secured for sowing in 1913. Tests were made of many substances as fungicides, but none was found to be of any practical value against wart disease. Modifications of cultivation such as removing the top soil were fairly effective. The determination of the rate of spread of disease through the soil was continued. A report has been published in *Field Experiments at the Harper Adams' Agricultural College, &c., for* 1912.

Cornflower (*Arb. Deut. Landw. Gesell.*, Heft. 240).—This publication gives a description, the life history, conditions of growth, and methods of eradication of the cornflower (*Centaurea Cyanus*). It is stated that the weed prefers sandy soils and is rare on clay soils; it is often abundant on marl, loam, chalk, and peat. It needs very little moisture and will survive very cold weather, even when not covered by snow. It needs a comparatively large amount of light, but by changes in its growth it can largely accommodate itself in this respect.

The most favourable conditions for its development are found in gaps in legumes, or in fodder crops, or still better in badly cultivated crops of potatoes. The weed chiefly infests winter wheat, its growth in this crop being luxuriant and its seed production large. Large quantities of seeds are also produced in seed clover, but not in clover for hay. Although the plant cannot be reckoned among the dangerous weeds, it must take away plant food, water and light from the cultivated crop, if present to a large extent.

The seeds germinate partly in the autumn after ripening, but principally in the following spring, summer and autumn; a few seeds may, however, remain dormant in the soil and germinate gradually under favourable conditions. Germination proceeds without difficulty up to a depth of 4 cm. (1½ in.), but is hindered at a greater depth than this. At considerable depth seeds can retain their germinating capacity for several years and germinate when at length brought to the surface. Autumn-germinating plants are always the most luxuriant and ripen the most seeds.

The weed is spread by the plant seeding itself, or the seeds may be introduced with the manure or the seeds of the cultivated crop, but hardly any danger need be apprehended from their introduction in farm-yard manure, as, according to one experimenter, their vitality is harmed by passing through the bodies of cattle, sheep and poultry, and according to the present experimenter seeds placed among farm-yard manure, but which had *not* passed through an animal's digestive tract, lost their vitality after the manure had been stored for three months.

The weed may be combated by eradication of the weed plants in the field, destruction of the weed seeds in the soil, and securing seeds of the cultivated crop free from weed seeds.

Young weed plants in autumn sown cereals can be destroyed by

harrowing in autumn and spring. In spring cereals the weeds germinating in autumn may be destroyed by autumn cultivation, while those germinating in spring will be destroyed by preparation of the seed bed in spring. The weed plants germinating after the seeding of the spring cereals will do little harm, but can be combated by harrowing and later by hoeing.

Destruction of the seeds of cornflower in the soil can be carried out, in the absence of any cultivated crop, by using carbolineum or chloride of lime; beside the surface seeds of cornflower, the seeds of numerous other weeds will be destroyed at the same time. It is generally believed that the application of large quantities of kainit is efficacious in destroying the grown plants, but there are no conclusive experiments on the point.

Wheat can easily be freed from seeds of the cornflower by winnowing. In the case of rape, clover and lucerne seed, sifting is preferable

POULTRY.

First Irish Egg-Laying Competition (*Journ Dept of Agric for Ireland, Oct*, 1913; *Miss L Murphy, Munster Institute, Cork*) —This article points out that too little attention is paid to increasing the egg production and the vigour of pure-bred stock, and that while large returns from poultry are obtainable only by a very few skilled breeders, there is a profitable margin between the cost of keeping a well-bred pullet and the value of her output of eggs for the year A list of the foods used and their prices, method of feeding, method of calculating values, and treatment for broodiness are given A comprehensive table shows in order of value the various breeds, the names of the principal winning owners, the number and value of eggs laid by each bird, and the total number and value of eggs produced by each pen

The following table gives the number of pullets penned, cost of food, value of eggs, and profit over cost of food :—

No. of pullets penned.	No. of eggs laid 1st Oct. to 31st. Aug.	Cost of food.	Money received for eggs.	Profit over cost of food.	Av. price per doz received for eggs.
	Doz.	£ s. d.	£ s. d	£ s. d.	d.
318	3,183½	88 7 7	178 12 9¾	90 5 2¾	13.05

The average cost of food per bird per week was as follows :—

	d
October to December (13 weeks)	1 54
January to March (13 weeks)	1.48
April to June (13 weeks)	1 31
July to August (9 weeks)	1 29

NOTES ON AGRICULTURAL CO-OPERATION.

Co-operative Cow Insurance Societies in 1912.

Registered Societies.—At the end of 1912 there were in operation, in England and Wales, 22 Co-operative Cow Insurance Societies, registered under the Friendly Societies Act—the same number as in the previous year. Statistics have been obtained for 21 of these societies for the year 1912. The total number of members was 1,498, giving an average of 71 members per society, the number varying from 12 in one society to 298 in another The number of cows and calves insured was 4,639 (as compared with 4,517 in the previous year), or an average of 221 animals insured per society and 3 1 animals insured per member. The smallest number of animals insured for any one society was 12, and the largest 1,395 The number of animals on which claims were paid during the year was 113, or an average death-rate of 2.4 per cent. of the animals insured, as against 2.6 per cent in the previous year. The amount paid on claims, after deducting income from sale of carcasses, was £933, while the income from insurance contributions was £938, which just covered the losses of the year The total expenditure charged to the insurance fund was £1,030, while the total income of that fund was £1,145, which included, besides the £64 received from sale of carcasses, £108 received as interest, and £15 from special levies made in the case of two societies For all the societies put together, therefore, the working of the year resulted in a net gain of £115, and the reserve funds rose from £4,757 at the beginning of the year to £4,872 at its close There was also a small balance to the credit of the management fund, and the total assets of these societies at the end of the year, after deducting their total liabilities, amounted to £4,881, almost the whole of which was deposited in the Savings Bank. This is nearly equal to five times the losses of the year, so that it forms a very good security to the members against the risk of having to make special levies to meet deficiencies in the funds; and on the whole these societies are evidently in a satisfactory financial position. A detailed account of the system of co-operative insurance was given in this *Journal* for May, 1912, and for November, 1912, and it is instructive to work out the average experience for the last two years, for which statistics are now available.

The Death-rate.—These societies all pay insurance claims on any

Year.	No. of Societies Reporting.	No. of Cows and Calves insured.	No. of Cows and Calves on which claims were paid.	Average death rate per cent. per annum.
1910 ..	17	4,243	94	2.2
1911 ..	22	4,517	118	2.6
1912 ..	21	4,639	113	2.4
Average	20	4,450	108	2.4

insured cow or calf which dies or has to be slaughtered in consequence of disease or accident.

Taking the experiences of the three years together, the average death-rate for these societies has been 2.4 per cent. per annum on 4,450 animals. The highest mortality occurred in the very dry year 1911.

Amount Payable per Cow or Calf.—Last year, on 113 animals that died, the amount paid by societies was £997; deducting from this the £64 received from sale of carcasses, the net loss to the societies was £933, or an average of £8 5s. per animal that died and of 4s. per animal insured. The experience of the last two years is as follows:-

Year.	No. of Animals insured.	No. of Animals that died.	Amount paid on claims.	Receipts from sale of carcasses.	Net Loss.	Average per Animal that died	Average per Animal insured.
			£	£	£	£ s.	s. d.
1911..	4,517	118	1,019	36	983	8 7	4 4
1912..	4,639	113	997	64	933	8 5	4 0
Average	4,578	116	1,008	50	958	8 6	4 2

From the experience of these two years, it appears that a society may expect to have to pay on the average £8 6s. per animal that dies, and that to cover the losses under the present rules and practice a net premium income of 4s. 2d. per animal insured would be required.

Amount of Premium Paid.—The experience of the last two years has been as follows:—

Year.	No. of Animals insured.	Amount of Insurance Contributions and Levies Received.	Average per Animal insured.
		£	s. d.
1911	4,517	936	4 2
1912	4,639	953	4 1
Average ..	4,578	945	4 2

The income received under this head by itself almost exactly equalled the net loss on claims, leaving as clear profit the interest received on accumulated funds.

Management Expenses.—In the case of 15 societies a separate account was kept of the income and expenditure of the management fund, and in the case of these societies the expenditure amounted to £95 in the course of the year, including £47 for salaries. As those societies altogether insured 4,073 animals, the average expenditure per animal insured was 6d., as compared with 5d. in the previous year.

Unregistered Cow Insurance Societies.—Besides these registered societies there are, according to the information at the disposal of the Board, 113 similar societies for the insurance of cows, which have not

been registered. Statistics for 1911 have been received for 64 of these clubs, which consist of 2,081 members, an average of 33 members per club. The number of cows these clubs insured was 5,335, an average of 83 cows per club and of 2.6 cows per member. Of these, claims had to be paid on 146 cows during the year, an average death-rate of 2.7 per cent. per annum. The amount paid in claims was £1,347, an average of £9 5*s.* per animal that died, and of 5*s.* 1*d.* per animal insured. Against this, however, should be put the amount realised on the sale of carcasses, which has not been ascertained. The total amount received in insurance contributions was £1,445, an average of 5*s.* 5*d.* per animal insured. These 64 clubs had at the end of the year reserve funds amounting to £5,542, equal to four times the amount paid on claims during the year, so that evidently most of them are in a satisfactory position.

Summary of Experience.—Thus we have the experience of 86 Cow Insurance Societies in different parts of the country, consisting of 3,579 members, and insuring 9,974 cows and calves per annum, according to which the average death-rate to be expected by such a society is about 2½ per cent. per annum of the cows insured, and the average loss, after deducting income from sale of carcasses, is likely to be well under 5*s.* per cow per annum. So that if a society, in an ordinarily healthy part of the country, charges this amount of insurance contribution, and 1*s.* per cow per annum for costs of management, it may reasonably expect, like most of the existing societies, to build up gradually a substantial reserve fund, which will relieve its members of the risk of having to make a special levy on themselves to meet the losses of an exceptional year.

The 86 societies mentioned now hold reserves of over £10,000, almost the whole of which is deposited in the Savings Bank. As the insurance contract is completed quarter by quarter, this sum represents the net assets of the societies, and has been accumulated out of the profits of working since the commencement of each society. This is a very satisfactory state of affairs; but it is obvious that there must be some limit beyond which it is not reasonably necessary to add to the reserve. It is perhaps enough for each society to aim at providing a reserve fund, which by itself would be sufficient to meet the losses of five years; and as the full statistics available for registered societies show that the loss represented by claims, after deducting the amount received from sale of carcasses, amounts on the average to about 4*s.* per animal insured, it would seem sufficient for a society to aim at accumulating a reserve fund equal to £1 per animal insured. This position has already been attained by a number of these societies. Some of them, recognising that the reserve was larger than necessary, have distributed, or arranged in their rules to distribute, the surplus among the members. It seems wasteful to dissipate in this way the savings which the society and its members have accumulated by the good management of past years, and it would appear to be more in accordance with co-operative principles and more beneficial to the members of the societies if, instead of dividing the surplus, societies were to follow the example of the Kemerton and Bredon Pig Clubs and the Prees Cow Club, which utilise their strong financial position to reduce the charge made to old members of the society, while retaining the full rates of contribution for new members. Under an arrangement of this sort, the Prees Cow Club has recently reduced the total charge

made to members of ten years' standing to 3*s.* per cow per annum; and, in return for this small payment, each of the old members has his cows insured with the society to their full market value, subject to a maximum of £12. Accordingly, in the model rules for Cow Insurance Societies, based upon the experience of existing cow clubs, which the Board hope to issue shortly, it is provided that whenever the balance at the credit of the insurance fund is shown by the audited accounts of any year to exceed the equivalent of £1 per animal on the maximum number of animals insured during the year, the insurance contributions of all members of over five years' standing shall be reduced to one-half the usual rates for the following twelve months. If this rule is adopted by existing societies, those societies which have already accumulated a reserve fund exceeding this amount will be able at once to give a substantial reduction in insurance contributions to all their old members without any risk of reducing their reserve below a safe limit.

Re-insurance.—Each of these small local societies is self-supporting and independent, and undertakes the whole of its own risks. There is always a danger that, owing to the outbreak of an epidemic in the area covered by the society's operations, its losses may be considerable, and may involve the exhaustion of the reserve fund and the necessity of making a levy upon the members to make up the amount required to pay the losses. This risk, however, is not so great as at first sight appears There has been no outbreak of cattle plague in this country since 1877, or of pleuro-pneumonia since 1898 There was no outbreak of foot-and-mouth disease during the years 1903-7; only three cases occurred in 1908, two in 1910, 19 in 1911, and 83 in 1912; the number in the last year was most exceptional, yet the average for the five years 1908-12 is only 20 outbreaks, with 105 cattle attacked, and 721 slaughtered as diseased or exposed to infection. The number of cattle returned as attacked by anthrax has on the average of the last five years been only 1,089 per annum. Seeing that there are in Great Britain seven million cattle, it is obvious that the risk to any individual cow of being affected by any of these diseases, or of being slaughtered in connection with an outbreak of cattle plague, pleuro-pneumonia or foot-and-mouth disease is very small. In the case of these three diseases, moreover, when an animal is slaughtered by order of the Board of Agriculture and Fisheries, compensation, either in full or in part, is paid by the Board, and the amount of compensation awarded may, under the Diseases of Animals Act, 1894, be deducted from the amount payable as insurance. A local insurance society, therefore, has only to make up the difference, if any, between that compensation and the amount payable under the policy; so that even in the case of an outbreak of one of these three diseases in its area, a local insurance society might not have to pay any large amount of compensation.

There is, however, always the possibility that, owing to a succession of bad years, the losses may considerably exceed the insurance contributions of those years, and in such a case it may become necessary for the society either to draw upon its reserve or to make a levy upon its members. This risk can be greatly reduced by a system of re-insurance under which a larger body would undertake, in return for a proportion of the insurance contributions, to pay a proportion of the losses incurred by a society. Such a system has been arranged by the Agricultural and General Co-operative Insurance Society, Limited, Dacre House, Dacre Street, Westminster, London, S.W., which has expressed its willingness

to re-insure half the net risks of any approved local co-operative cow insurance society, on payment of half the insurance contributions received by the local society, less 10 per cent. of that half. When a local society has entered into such an arrangement with the General Society, it will only have to provide for half the net loss incurred on the death of an insured cow, while it will retain 55 per cent. (that is, more than half) of the insurance contributions; and, should it have to make a levy on its members owing to a deficiency in its own insurance fund, that levy would only have to be half what it would have been if the society had not made the contract of re-insurance A further great advantage is that it will not be necessary for the local society to build up such a large reserve fund as if it had to depend entirely upon its own resources, seeing that the amount it will have to provide for in the case of a deficiency will only be half of what it is in the case of a society which has not re-insured its risks.

The experience of existing registered societies shows that on the average a society, which had made such a contract of re-insurance, would only have to find an amount equivalent to about *2s.* per cow per annum towards meeting its half of the losses, so that a reserve fund of *10s* per animal insured would be sufficient to cover the average losses of five years. Therefore it would seem safe for a society, which has re-insured half its risks, to grant to its old members the benefit of a reduction of the insurance contributions to half the usual rates, whenever the balance at the credit of the insurance fund exceeds the equivalent of *10s* per cow insured

It will be necessary for each local society, which wishes to re-insure on these terms, to satisfy the General Society that its rules and financial position are sound, and to obtain that Society's consent to the reduction of the insurance contribution payable by old members when its reserve exceeds the amount above described. Should the application be accepted and the consent of the General Society obtained to the alteration of the rules to the above effect, the old members of many existing societies, which have already built up a good reserve fund, will have their insurance contributions at once reduced to half the usual rates, that is, in an average society, to about *2s.* per cow per annum, making, with the contribution for management expenses, a total payment of about *3s.* per cow per annum to cover loss by death from accident or disease.

Agricultural Credit Societies in 1912.*

In the *Journal* for December, 1911, an article was published dealing with the statistics of Agricultural Co-operative Credit Societies for the year ending 31st December, 1910. The statements attached to the article contained the names of 40 societies, but of these nine had either failed to send in returns to the Registrar or reported that they had done no business, and of the remaining 31 only 21 had made any loans to their members or received deposits during the year. The figures for 1912 are now available, and it is worth while to compare them with those for 1910. Six of the societies which made no loans in the latter year have ceased to exist, but six new societies were started in 1911, and six in 1912. The elimination of societies which were doing no business is not a matter for regret.

*Contributed by the Agricultural Organisation Society.

AGRICULTURAL CREDIT SOCIETIES REGISTERED UNDER THE FRIENDLY SOCIETIES ACT (WITH THE SPECIAL AUTHORITY OF THE TREASURY).—General Statement for the Year 1912.

COUNTY.	NAME OF SOCIETY.	Year of Registration.	No. of Members		Loans granted during the year.		Rate of Interest received by the Society.		Rate of Interest paid by the Society		Profit to end of 1911.	Loss to end of 1911.	Profit to end of 1912.	Loss to end of 1912.
			At beginning of year	At end of year.	No.	Amount.	On Loans to Members.	On other Advances and Investm'nts	On Deposits.	On other Borrowings.				
ENGLAND						£ s. d.					£ s. d.	£ s. d.	£ s. d.	£ s. d.
Bedfordshire ..	Clophill	1905	19	18	8	31 0 0	5	—	—	4	1 2 5	—	1 6 8	—
	Wilshamstead ..	1912	—	9	2	15 0 0	—	—	—	—	—	—	0 8 3	—
Buckinghamshire..	High Wycombe ..	1908	13	13	5	32 0 0	6	—	—	4½	—	1 10 3	—	1 5 0
	Drayton Parslow ..	1909	22	22	9	96 10 0	6	—	3	5	1 17 8	—	2 10 4	—
Cambridgeshire ..	Coates .. .	1908	—	—	—	—	—	—	—	—	—	—	—	—
	Milton	1911	7	7	—	—	—	—	—	—	—	—	—	—
	Steeple Morden ..	1912	—	11	1	10 0 0	—	—	—	4	—	—	—	0 9 8
Essex	Coggeshall	1909	22	38	10	166 0 0	5	—	—	4	5 19 4	—	11 11 1	—
	Tiptree	1909	22	27	6	105 0 0	5	—	—	4	48 11 10	—	49 15 7	—
Hampshire ..	Hedge End.. ..	1896	35	37	15	186 0 0	4	2½	3	—	41 3 9	—	43 1 11	—
	Cosham	1912	—	20	—	—	—	—	—	—	—	—	—	2 13 11
Herefordshire ..	Froome's Hill ..	1908	11	11	—	—	—	—	—	—	—	0 2 8	—	0 2 8
Hertfordshire ..	Sleaps Hyde ..	1912	—	11	—	—	—	—	—	—	—	—	—	—
Kent	Bromley	1908	18	18	—	—	—	—	—	—	—	2 6 8	—	9 3 0
	Halstead	1910	15	15	4	33 10 0	5	—	—	4	0 18 5	—	3 4 2	—
	High Halstow ..	1910	9	7	—	—	—	—	—	—	—	1 0 0	—	1 0 0
	Well Hill	1911	11	11	—	—	—	—	—	4	0 10 3	—	0 4 8	—
Leicestershire ..	Brookvale	1907	43	43	2	8 0 0	5	3	3	4 and 5	2 2 7	—	0 0 11	—
	Mountsorrel ..	1908	29	29	2	60 0 0	5	—	2½	—	3 15 1	—	4 1 6	—
	Oadby	1910	19	19	1	6 0 0	5	—	—	4	—	2 6 9	—	0 5 4
Lincolnshire ..	Scawby	1895	32	35	9	249 10 0	5	3	3	5	69 14 8	—	73 5 0	—
	Friskney	1904	33	37	4	132 0 0	5	2½	3	4	8 7 2	—	9 5 2	—

						£ s. d.					£ s. d.	£ s. d.	£ s. d.	£ s. d.
Middlesex ..	"All for Each," Southall ..	1908	10	10	—	—	6	—	3	—	0 5 0	—	0 5 0	—
Norfolk	Wiggenhall ..	1896	44	46	7	104 0 0	5	3	4	3	79 0 4	—	80 10 2	—
	Whissonsett ..	1905	26	26	16	81 0 0	5	2½	3	4	4 11 4	—	6 13 6	—
	Wayford	1910	2	12	5	29 12 0	—	—	—	—	—	—	0 5 5	—
Northamptonshire	Moulton	1911	11	11	—	—	—	—	—	—	1 7 6	—	1 7 6	—
	Spalding	1904	76	71	1	12 0 0	5	5	4	—	0 12 1	—	0 10 6	—
Nottinghamshire	Mansfield Woodhouse	1910	9	14	38	169 14 2	—	—	—	—	—	0 1 6	2 17 7	—
Oxfordshire ..	Islip	1910	17	16	2	10 0 0	6	—	—	5	0 9 10	—	—	1 19 0
	Hevford	1910	12	12	—	—	—	—	—	—	—	—	—	—
Suffolk	Laxfield	1895	6	6	—	—	5	2½	3	—	13 9 7	—	13 18 1	—
	West Row	1912	1	25	13	100 0 0	5	—	—	4	—	—	0 9 8	—
Surrey	Limpsfield	1909	20	18	2	10 0 0	5	2½	—	—	0 3 2	—	0 19 10	—
	Croydon	1909	41	42	—	—	5	2½	3	—	—	7 13 8	—	3 10 9
	Epsom	1910	—	—	—	—	—	—	—	—	—	—	—	—
	Reigate	1912	8	8	4	160 0 0	—	—	—	—	—	—	2 10 0	—
	Chobham	1911	13	13	—	—	—	—	—	—	0 1 8	—	0 1 8	—
Worcestershire ..	Castle Morton ..	1896	20	20	6	30 0 0	6	2½	3	4	4 2 0	—	5 0 10	—
	Far Forest	1904	7	7	—	—	6	2½	4	3	0 17 8	—	0 13 10	—
	Cradley	1910	11	11	—	—	—	—	—	—	0 10 10	—	0 10 10	—
	Pinvin	1911	13	15	9	48 0 0	6	—	—	4	—	—	1 15 0	—
Yorkshire ..	Adwick-le-Street ..	1911	6	6	—	—	—	—	—	—	—	1 2 9	—	1 2 3
	Total—England ..		713	827	181	1884 16 2	—	—	—	—	289 14 2	16 4 3	317 4 8	21 11 7
WALES. Glamorganshire ..	St. Fagan's.. ..	1909	14	13	1	10 0 0	—	—	—	—	0 16 11	—	0 16 9	—
	Cadoxton	1909	9	12	—	—	—	—	—	—	—	—	—	0 1 3
	Barry	1910	11	11	—	—	—	—	—	—	—	—	—	—
	Total—Wales ..		34	36	1	10 0 0	—	—	—	—	0 16 11	—	0 16 9	0 1 3
	TOTAL (46 Societies)		747	863	182	1894 16 2	—	—	—	—	290 11 1	16 4 3	318 1 5	21 12 10

It is interesting to notice that one of the new societies, that of Adwick-le-Street, is in Yorkshire, as it is the first example of a rural credit society to the north of the Humber.

Confining attention to working societies, that is, societies which granted loans or received deposits, the figures for the two years compare as follows .—

Year.	Working Societies.	Members.	Loans granted during year.		Deposits received.	Profit to end of year.
			Members	Amount.		
				£	£	£
1910 ..	21	536	119	1,390	237	253
1912 ..	29	711	182	1,895	332	297

In 1910, nineteen, and in 1912, twenty-six, societies made loans to members In the latter year the loans averaged £73 per society and £10 per borrowing member Only one quarter of the members took loans A few societies still have to report a petty amount of loss, and in no case does the accumulated profit yet reach £100, the highest figures being Wiggenhall in Norfolk, £81, and Scawby in Lincoln, £73. Progress is very slow, but a more rapid advance may be looked for when the movement is better understood and some existing difficulties have been overcome. The chief of these has probably been the difficulty of obtaining working capital out of which to make loans. It might also smooth the way if arrangements were made to give societies desiring it more skilled advice in the first years of their existence.

English credit societies so far have had no share capital, which is an essential feature of all the German societies whether with unlimited or limited liability. The members merely contribute small entrance fees to the common stock

As the result of communications between the Board and 22 of the leading Commercial Banks, the latter have expressed their willingness to consider favourably applications for advances made by credit societies which consist mainly of smallholders and allotment holders, and whose rules provide for unlimited liability. Interest will be charged at a favourable fixed rate subject to a year's notice of alteration. Loans to societies will, in accordance with ordinary banking practice, be made repayable on demand, but in general practice will remain current for 12 months, and will then be subject to repayment, renewal or reduction. A society conducting its business with prudence need be under no apprehension of the sudden recall of a loan Managers of country branches will be allowed to help in the formation of credit societies, to advise in matters of book-keeping, and to take part, when requested, in the audit of the annual return without remuneration Some advantage has already been taken of these new facilities, and it is to be hoped that well-managed societies will now find that they can finance themselves on reasonable terms.

The practical difficulty of obtaining capital has probably had more to do with the slow advance of the Co-operative Credit Movement than any fear of unlimited liability. All existing societies are registered under the Friendly Societies Act, and are subject to rules framed by

the Agricultural Organisation Society, under which all members undertake joint liability to the full extent of their property. But alternative rules are being drawn up for societies with limited liability and shares, on which interest may be paid not exceeding 5 per cent., the residue of the profits being carried to a separate indivisible reserve.

Louth and District Shire Horse Society.

This Society was established some years ago for the purpose of improving the breed of Shire horses in Louth and the surrounding district by obtaining the services of first-class registered sires

The annual subscription for membership is 10*s*. 6*d*., payable on the 1st January, and the total number of members is 60. The affairs of the Society are managed by a President, Secretary, Auditor, and 13 members as a General Committee Three members are annually elected by ballot to select a horse for the use of the Society for the ensuing year Members desiring to make use of the services of the horse are required to send in nomination papers in the week preceding the London Shire Horse Show, together with half the nomination fee—the remaining half being payable by the 3rd October The fee is fixed each year by the Committee according to the amount payable for the hire of the horse for the season, but may not exceed five guineas except with the sanction of the members at a special meeting. Each member is allowed one nomination, and no member is allowed to take more than two nominations if the list is otherwise full. Should sufficient nominations not be received from members, the Committee may allot the remaining nominations to non-members at such fee as they may fix. No member is allowed to dispose of a nomination without the sanction of the Committee, and every mare nominated must be paid for unless the Committee decide otherwise. Should the horse hired by the Society be incapacitated from fulfilling his services to all his nominations during the recognised season, the members who have in consequence to use the provided substitute have to pay only half the fee for the season. Each member is supplied with a nomination card for each mare entitled to be served, specifying her name, age and colour, and this card must be produced to the groom before the mare is tried for service No mare can be served twice within 14 days without the consent of the Selection Committee No gratuities are to be paid to the groom in charge of the horse; and the Committee accept no responsibility for any damage that may occur during the time of trial or service

According to the accounts of the Society for the last six years, the amount paid for the hire of the horse has varied from £315 to £840, and has averaged £491 The cost of insurance against breakdown of the stallion has averaged £13, the Secretary's remuneration £10, expenses of the Selection Committee £16, sundries £21; making a total average expenditure of £551.

The average income has been as follows:—

	£
Service Fees	498
Members' Subscriptions	32
Entrance Fees	8
Interest	6
Subscriptions received from Honorary Members	22
Total Income	£566

This shows an average profit on the working of the scheme of £15 per annum, and the balance in hand to the credit of the stallion account has increased during these six years from £212 to £303. During four of the six years the year's working showed a substantial balance of profit, but during the last year there was a loss of £84, due to the fact that the Society hired an exceptionally good stallion at £840, but charged only six guineas to members for his services, so that the income from service fees fell £107 short of the cost of hire.

The rates charged each season are fixed by the Committee according to the amount paid for the hire of the horse, and have varied during the six years for members from three to six guineas, and for non-members from five to twelve guineas. The stallion is hired subject to a limitation of his services to 110 mares, and the average number of mares actually served has been 108. The income from service-fees averaged £498 per annum, which is equivalent to an average of £4 12s. per service. Last year the Committee hired "King of Tandridge," 24351, foaled in 1905, for the sum of £840 with £21 returned for prizes in 1914, to serve 110 mares, and they have again hired the same stallion for next year at the same rate.

It is reported that the Society has done an immense amount of good in the district by providing high-class Shire stallions for the use of members (who are *bona fide* tenant farmers, several in a small way keeping one mare for breeding purposes), at a fee considerably lower than would have been possible had the mares had to be sent away to similar stallions, and that the establishment of the Society has resulted in a much better quality of "Shires" in the district.

Apart from the hire of the horse, the expenses of the Society during the last six years have averaged as follows :—

	£	s	d
Insurance	12	16	0
Secretary's remuneration	10	0	0
Expenses of Selection Committee	15	15	0
Miscellaneous Expenses	21	1	0
Total..	£59	12	0

Against this, excluding the service fees, the income of the Society has been as follows :—

	£	s.	d.
Members' Subscriptions and Entrance Fees	40	3	0
Interest	5	13	0
Subscriptions from Honorary Members ..	22	7	0
Total	£68	3	0

so that, apart from the subscriptions of honorary members, there was an average loss on working expenses of £14 a year. The average amount received in service fees slightly exceeded the average cost of the hire of the horse, although it fell £107 short of it in the last year.

To put the Society on a self-supporting basis and make it independent of subscriptions from honorary members, it would apparently be necessary to charge a management subscription of say 12*s*. per mare served (instead of 10*s* 6*d*. per member), which on 108 mares would give an income of £65—enough to meet the average expenses of management; and if the fee charged for the services of the horse were fixed at one per cent. of the hire of the horse for the season, this would give on 108

mares a net income under this head of 8 per cent. of the hire of the horse, which could be added to the reserve fund. A reserve fund is necessary to meet any increase of expenses, or any possible loss of income due to a failure to secure the full number of 110 nominations in any season. The Society protects itself against loss due to the breakdown of the stallion by taking out a policy from an Insurance Company. The arrangement made for 1912 was that the Society paid the Company a premium of £13 6s 8d., in return for which the Company agreed that in the event of the stallion being totally disabled from service through death, accident, illness or disease between the 25th March and the 15th July the Company would pay the Society £40 per week of such total disablement, commencing only after the expiration of one week's disablement, and not exceeding in all a total period of four weeks, whether in respect of one or more periods of disablement.

Co-operation among Poultry Farmers in Holland.*

In Holland a society, generally known as the V.P.N., has been formed for the encouragement and promotion of poultry farming. It has branches all over the country, one of which, with its headquarters at Leeuwarden, embraces the four northern provinces. This branch works entirely on a co-operative basis, and consists of over 5,000 members, who are chiefly producers, small and large: it has numerous sub-societies in the villages, through which the local members forward their eggs to Leeuwarden in bulk, thus saving packing and carriage. The head office provides packing-boxes, capable of holding from 300 to 500 eggs each, and pays half their cost, the other half being paid by the local society. The cost of carriage, which is mainly by water, is small. Each farmer's account is made up once a fortnight, and he can then draw whatever sum is due to him. Each member has a number in the office register, and is supplied with a rubber stamp, with which he marks each egg with his particular number. Every egg is carefully tested at the chief depot by electric light, and should any egg not be up to the standard, the consignor, who can be readily identified by his number, is fined. The eggs are graded by fitting them in holes, and are also weighed, the average weight of 120 eggs being 13.2 lb. They are then packed in "wood wool" in light boxes containing from 1,260 to 1,440 eggs. The Leeuwarden depot can deal in this way with about half a million eggs per week, and marks each egg with the letters V.P.N. as a guarantee of its quality. The supply from the country is so regulated that no eggs older than nine days remain in stock.

During the year 1912 the V.P.N. despatched from Leeuwarden nearly 12 million eggs, and it is expected that the sales during 1913 will amount to over 15 million. The price at which the eggs are sold varies from about 6s. 6d. per 120 eggs in summer, to 17s. 6d. in winter; and when eggs are abundant in June and July, and prices consequently low, they are stored in cement tanks of a capacity of 10,000 eggs, filled with a liquid preparation of lime: eggs so kept remain good for six months and are chiefly used by bakers and confectioners during the winter. The greatest demand for Dutch eggs is from England and Germany. Those intended for England are usually shipped from Harlingen to London.

* Summarised from a recent Consular Report.

The V.P.N has also formed a department for dealing with dead poultry, which proves of great benefit to the members, and it despatched nearly 25 thousand birds in refrigerator vans during the eight months ending August, 1913 It also supplies its members at cash price with large quantities of poultry food of various descriptions and of the best quality, purchased through its own experts, and it gives advice gratis on the rearing of poultry. There are other societies in the district whose object it is to improve the breed of all kinds of poultry.

Co-operative Credit in India.

The co-operative credit movement in India, of which some account was given in the *Journal* for February, 1913, continues to make remarkable progress, as will be seen from the following statistics for the year 1912–13. The total number of co-operative societies in India increased in that year from 8,177 to 12,324; the total number of members from 403,318 to 573,536, and the total working capital from £2,238,000 to £3,562,000 Of these societies 251 are central societies, whose main object is to find capital for the local societies; 691 are non-agricultural societies, most of which have been established for the provision of credit facilities among residents of towns, although a few have now been started for co-operative purchase and sale, the remaining societies are agricultural societies formed among the rural population and, as they are by far the most important, attention may be confined to them

During the year the number of these agricultural societies increased from 7,562 to 11,382, of which 11,296 were co-operative credit societies and 63 were societies for the co-operative insurance of live-stock The number of members increased during the year from 325,000 to 467,000, and the working capital from £1,215,000 to £1,935,000 During the year members deposited with the societies £120,000 and repaid loans to the amount of £800,000; deposits were withdrawn to the amount of £64,000, and the new loans made to members amounted to £1,440,000. The amount of interest received by societies was £148,000, while the interest paid on loans and deposits was £91,000, thus leaving a margin of profit in interest of £57,000, or about 4 per cent per annum on the average amount out on loan, and as the charges for establishment and contingencies amounted altogether only to £13,000, or a little over £1 per society, there was a substantial profit on the working of the year. During the year the total assets of these rural societies increased from £1,295,000 to £2,040,000, of which £1,720,000 was out on loan to members (as compared with £1,112,000 at the end of the previous year). The liabilities of the societies to persons and bodies outside them amounted to £1,386,000, including £1,110,000 due to central banks and other societies, £210,000 borrowed from non-members, and £66,000 lent by the Government in backward parts of the country, so that, after deducting these liabilities to outsiders, the societies and their members between them ended the year with net assets of the value of £654,000 (as compared with £442,000 at the beginning of the year). This represents the amount which the establishment of these credit societies has enabled their members to lay by in the course of the last nine years. Of the £654,000, £487,000 was due to individual members in the form of share capital, deposits and interest, and after allowing for this amount and some other small items, the societies as such possessed £159,000, which represents their profits to date from the

commencement of the movement, and equals nearly 8 per cent. of their total assets

The most common rates of interest which the societies find it necessary to pay in order to secure the capital required for their working vary from 6 to 9 per cent.; and the most common rates charged by the societies on loans made to their members vary from about 9½ to 12½ per cent. These rates may sound high as compared with the rates current in western countries, but are only about half the rates usually charged by the village money-lender, even to a solvent small holder, and the rapidity with which the movement is spreading over the whole of India shows that the illiterate peasants have found that it meets their urgent needs, by providing them both with a safe place of deposit for their savings and with a means of borrowing small sums for their agricultural operations at a much lower rate of interest than they would otherwise have to pay.

Agricultural Co-operation in Saskatchewan.

Agricultural co-operation in Saskatchewan has so far only been applied to creameries, the marketing of grain and hail insurance. In each case the results have been very satisfactory and it is probable that, with the formation of a new branch of the Department of Agriculture for the encouragement of co-operative associations, the principle will be extended to a number of other branches of agriculture.

The system adopted as regards the co-operative creameries is as follows Five or more persons are allowed to incorporate themselves as a co-operative association and receive Government aid on complying with certain requirements All profits after paying a dividend of 5 per cent must be divided among the farmers according to the quantity of produce supplied There must be a demand for the creamery in the district and the produce from not less than 400 cows must be assured for at least three years Every creamery must have a capital of at least £1,000, and shares to the amount of three-quarters of this must be subscribed Incorporation can only be granted when two-thirds of the shares have been paid up. The Government is then prepared to lend any sum up to £625 at 3 per cent. interest and manage the creamery generally.

In the case of the co-operative organisations for the marketing of grain the capital equal to the cost of the elevator must be subscribed by the farmers concerned, 15 per cent being paid in cash. For each 10,000 bushel capacity of the proposed elevator the total crop acreage of shareholders must be not less than 2,000 acres The Government will then advance 85 per cent of the subscribed capital still unpaid, the loan being repayable in 20 equal annual instalments with interest at 5 per cent.

Under the Hail Insurance Act, passed in 1912, when 25 or more municipal districts agree to combine in insuring the crops within their boundaries against hail, authority is given to collect a special tax not exceeding *2d.* per acre (exclusive of town land and land held under grazing lease). The Hail Insurance Commission, which is the administrative body, decides the rate of the town. The funds from all the municipalities are pooled and claims and expenses are met from the common fund. In case of damage, 2½*d.* per acre for every 1 per cent. of damage suffered is paid. (*The Public Service Monthly*, Regina, November, 1913.)

OFFICIAL NOTICES AND CIRCULARS.

Foot-and-Mouth Disease.

The existence of foot-and-mouth disease amongst cattle at Whitwell, Hertfordshire, was confirmed on December 15th. The usual precautions were taken to prevent the spread of the disease, and an order was issued prohibiting the movement of animals in a large area surrounding the affected farm.

The restrictions imposed owing to the outbreak in Sussex on November 12th, have all been withdrawn, and those imposed in connection with the Hertfordshire outbreak have been considerably modified.

The restrictions imposed by Canada, Argentina and Jersey on English live stock were given in the *Journal* for December, pp. 827 and 828

Additional restrictions are as follows —

New Zealand —Shipments of cattle, sheep, or pigs from the counties of Sussex, Surrey, and Kent, will not be permitted Although no official communication has been made to the Board, it is probable that the prohibition now extends to Hertfordshire

United States —No permits will be issued for the shipment of ruminants and swine from Great Britain

Uruguay.—Cattle, sheep and swine may be exported from the United Kingdom to Uruguay if accompanied by an official certificate testifying *inter alia*, that no case of foot-and-mouth disease has occurred during the preceding six months in any county in which the animals have been located

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Leaflets in 1913.

The following new leaflets have been issued by the Board since the date of the list contained on pp 634–6 of the *Journal* for October last —

No. 277. *Tuberculosis of Farm Stock* , and No 281, *Apple Leaf-spot.*

No 192, *Farm Butter Making*, has been issued in Welsh

In addition, the information in the following leaflets has been revised :—

No. 10. *Wireworms*

No. 20. *Magpie Moth.*

No. 86. *Brown Rot of Fruit.* A paragraph has been added recommending the use of a lime sulphur spray as a preventive measure in districts where Bordeaux mixture is found to injure the apples.

No 100. *Breeding and Management of Pigs.*

No. 101. *Prevention of White Scour in Calves.*

No. 135. *Mange in Cattle* (re-written) The description of the mites causing the disease and of the symptoms is given in considerably greater detail than in the old leaflet.

No 137. *Varieties of Scab in Potatoes*

No 169 *Cultivation of Mangolds.*

No 179 *Making of Soft and Cream Cheeses and Clotted Cream*

No 231. *Cheese-making for Small Holders*

No. 242 *Bacteriosis of the Potato and Tomato*

No 253 *Microsporidiosis of Bees, or Isle of Wight Bee Disease.*

No. 257. *The International Agricultural Institute.* The subscription rates for the publications of the Institute have been revised.

No. 275. *Improvement of Poor Hill Pasture.* The suggested method for the eradication of bracken has been revised.

The Possibility of Reviving the Flax Industry in Great Britain.

With this number of the *Journal* the Board publish as a supplement (Supplement No. 12) a report by Dr. J Vargas Eyre on the Possibility of Reviving the Flax Industry in Great Britain. This report was prepared by Dr. Eyre in response to a request by the Development Commissioners in 1911 for information on this subject, and was of such interest and value that it has been thought desirable to issue it in the form of a supplement in order that farmers may avail themselves of the practical details brought together An article on "The Growing of Linseed for Feeding Purposes" was published in the *Journal* in August, 1913, and a leaflet based on that article has now been issued The present supplement, however, deals much more fully with the possibilities of reviving the flax industry in Great Britain, and the Board hope that its publication in its present form will serve a useful purpose.

The price of the supplement is 4*d*, post free, it will be supplied to subscribers free

Insufficient Pollination of Fruit Trees.

The Board of Agriculture and Fisheries desire to inform fruit-growers that they are engaged in an enquiry through their Horticulture Branch into the failure of fruit trees to set properly through insufficient pollination, and they would be glad to be put in communication with the occupier of any orchard of five acres and upward who has reason to believe that his trees are bearing less than the normal crop over a series of years Fruit-growers who are planting new orchards are also invited to communicate with the Board

MISCELLANEOUS NOTES.

Production of Sulphate of Ammonia.

The Report of the Chief Inspector of Alkali Works for 1912 (H.C. 170, 1912) shows that there were 581 works or separate processes for the manufacture of sulphate and muriate of ammonia in England and Wales, as compared with 570 in 1911 and 543 in 1910, the number having steadily increased from 449 in 1904. In Scotland the number of such works was 106 There were also 54 gas liquor works in England and six in Scotland

The quantity of sulphate of ammonia produced in the United Kingdom is shown in the following table —

Source.	1912.	1911.	1910.
	tons	tons.	tons.
Gas works	172,094	168,783	167,820
Iron works	17,026	20,121	20,139
Shale works	62,207	60,765	59,113
Coke-oven works	104,932	105,343	92,665
Producer-gas and carbonising works (bone and coal)	32,049	29,964	27,850
Total	388,308	384,976	367,587

These figures show an increase over the production of 1911 of 3,332 tons The United Kingdom was formerly the most important sulphate of ammonia producing country, but in recent years Germany has taken first place. The following figures of the world's production of sulphate of ammonia (those for the United Kingdom being corrected) are given by the German *Ammoniak-Verkaufs-Vereinigung* (*Die Ernahrung der Pflanze*, No 13, 1913) :—

	1912.	1911.
	tons.	tons.
Germany	484,000	411,000
United Kingdom .	388,000	385,000
United States	149,000	113,000
France .. .	68,000	59,000
Belgium . .	49,000	39,000
Italy	15,000	—
Other Countries	172,000	167,000
Total	1,325,000	1,174,000

The total production in the United Kingdom in 1912 was 388,308 tons, and 287,000 tons were exported, so that the balance remaining for home consumption for all purposes amounted to 90,000 tons, as compared with 93,000 tons in 1911 and 84,000 tons in 1910 The exports of sulphate of ammonia are principally to the United States, Japan, Spain, Dutch East Indies, and Italy.

The "direct" method of producing sulphate of ammonia, *i e.*, by exposing the gases resulting from the carbonisation of coal to the action of sulphuric acid instead of removing ammonia from these gases by a washing process producing gas liquor or ammoniacal liquor, was put into more extended use during the year

Attention continued to be given to the formation of a commercial salt of ammonia, such as the sulphate, from gases containing ammonia and sulphuretted hydrogen without the use of sulphuric acid, but with very little practical result.

In the table below are shown the imports of the materials used in the fertiliser trade, the principal being mineral phosphates A proportion of the nitrate of soda imported is used in the manufacture of sulphuric and nitric acids —

	1912.	1911.	1910.
	tons.	tons.	tons.
Basic slag ..	49,313	22,666	16,588
Bones, burnt and unburnt	41,203	45,883	44,505
Guano	14,115	34,124	20,395
Nitrate of soda ..	123,580	128,487	126,498
Mineral phosphates	520,267	493,415	455,593

The number of chemical manure works under inspection in 1912 was 194, as compared with 217 in 1901.

Free Carriage of Pedigree Live Stock to South Africa.—The South African *Government Gazette* of October 14th, 1913, contains various conditions to be read in conjunction with the existing regulations governing the importation of pedigree live stock free of freight into South Africa by the Union Castle Steamship Co, Ltd. (See note in this *Journal* for July, 1913, p. 351).

Importation Regulations.

These conditions provide that no stock under the age of eight months will be accepted for shipment free of freight Mares in foal will not be accepted for shipment after the sixth month of pregnancy and cows in calf after the fifth month, and the veterinary certificate accompanying the animals must specify the degree of their pregnancy. Very young calves and foals when accompanied by their dams will be accepted for shipment only on payment of the usual rates of freight for such young animals

To avoid confusion on delivery, animals must bear distinctive marks of a nature not to be effaced or removed during the voyage. Horned cattle should be branded on the horn and polled cattle and horses on the hoof with a number and the initial of the surname of the owner, while sheep and pigs, if not ear-tagged, should have the owner's name stencilled on the crate. In all cases these identification marks should appear on the pedigree or other certificates.

The certificate of approval issued by the High Commissioner and the relative documents must be lodged with the steamship company at least *seven* days before the stock is delivered alongside the steamer.

Importation of Plants into Northern Rhodesia.—The Board have received through the Colonial Office a copy of the regulations recently issued under the Importation of Plants Regulations Proclamation 1913, affecting the importation of plants into Northern Rhodesia

The regulations declare Livingstone, Fort Jameson and Feira to be ports of entry It is provided that persons introducing plants (including portions thereof such as tubers, bulbs, roots, cuttings, grafts, fruits or seeds) into Northern Rhodesia must, on or before the date of introduction, furnish to the principal officer of Customs at the port of entry a seller's certificate stating the quantity to be imported, the exact locality in which the plants were grown and also that they are free from any insect or disease Any plants imported in contravention of these regulations will be liable to detention or destruction.

Importation of Swine into the Argentine Republic.—Information has been received through the Foreign Office of a Decree, dated November 4th, 1913, which provides that swine imported into the Argentine Republic, after undergoing quarantine in accordance with the regulations governing the importation of animals, must in future be subjected to the tuberculin test. All animals reacting to the test will be slaughtered. (*Board of Trade Journal*, December 18th, 1913)

Importation of Live Stock into Russia.—The Board have been furnished with a copy of the provisional regulations affecting the importation of live stock into Russia. The regulations may be seen by persons interested at the offices of the Board, 4, Whitehall Place, London, S W.

Notes on Agriculture Abroad.

Third International Congress of Tropical Agriculture.—The Board have been informed that the Third International Congress of Tropical Agriculture will be held at the Imperial Institute, London, S W, from June 23rd to 30th, 1914 The principal object of the Congress is the discussion of ways and means of improving agriculture in the tropics and thereby increasing the production of the numerous food-stuffs and industrial raw materials derived from tropical countries The Congress is being organised by the British Section of the International Association for Tropical Agriculture and the president of the Congress is Professor Wyndham Dunstan, C M G, F R S

Fifth International Congress of Rice Culture.—The Board have been informed that the Fifth International Congress of Rice Culture will meet at Valencia in the second fortnight of May, 1914 Correspondence relating to the Congress should be addressed to M le Commissaire Royal de Fomento de Valence (Espagne), Plaza San Luis Beltrán. Letters should be marked "Congress Internacional de Arroces"

Competition of Ploughs in South Africa.—A competition of ploughs will be held at Cradock (Cape Province), on March 6th, 1914 The trials should prove of great value to United Kingdom manufacturers interested in the South African market Entries will be received, up to February 10th, 1914, by the Secretary of the Cradock Agricultural Society, Fish River Station, Cape Province A pamphlet setting out the conditions for the competition can be seen at the Commercial Intelligence Branch of the Board of Trade (*Board of Trade Journal*, November 27th, 1913)

Cultivation of Flax in Holland.—An account of the cultivation of flax in Holland is given in the *Deut Landw Presse* of 8th November, 1913 It appears that the plant is now grown only on fertile clay soils in the Netherlands and no longer on sandy soils In the north of the country it is sown mostly after oats or wheat, in the provinces of South Holland and Zeeland it is often sown after clover, but there is no fixed rotation In Friesland and Groningen white clover is usually sown with the flax, but this is not usual in the south. In Zeeland the practice of sowing red clover in the flax is gaining ground It is also customary in Zeeland to let the land lie fallow for a few months The ground which is to serve as a seed bed for flax is got into as fine a tilth as possible As a rule, small dressings of artificial manures are given, farmyard manure, it is stated, not being used Sowing is carried out in almost all parts of Groningen and Friesland by a distributing machine, while in the south of the country drilling is increasingly practised

Where blue flax is cultivated the seed is usually obtained from the Baltic provinces of Russia In Groningen, as a rule, seed from crops grown only one year in Holland is used; but elsewhere the seed is often obtained from crops grown in the country for two or three years.

In districts where the finest product is obtained the flax is harvested early. White flax is commonly harvested last In Groningen, as soon as the flax is pulled and tied into bundles, it is taken as quickly as possible to the clover "horse" and completely dried.

Economic causes confine the industry in Holland within narrow limits. The plant can only be cultivated on soils which are not too heavy, are well drained, and are comparatively free from weeds. It is

considered that it can only be grown once in every 6–10 years on the same field. On suitable land, even, it is a very risky crop, mainly on account of the weather, although it may pay extremely well. (This is evidenced by the high rents for "flax" land.)

There are a number of advantages in growing the crop. It is a good covering crop for clover on account of the great care bestowed on the seed bed, the small amount of shade, and the early harvesting of the flax. For this last reason the field can be quickly broken up for a succeeding crop. The flax crop is of great benefit in the rotation on account of the large amount of weeding done.

A further economic advantage, it is stated, is the large amount of labour the crop necessitates. The cost of the labour up to harvest is given as £2 to £2 13*s.* per acre, and for rippling and further treatment of the seed £1 to £1 6*s.* per acre. It is important to note that these last operations can be carried on in winter.

Russian Bureau for Agricultural Engineering.—According to a note in the *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft* (November 15th, 1913) this Bureau was formed in 1907 in order to assist in the solution of the various problems connected with agricultural engineering. Experimental fields were acquired at St. Petersburg, Akimowka and Tashkent (Turkestan), and sub-stations have recently been formed at Akimowka and in Caplanbeck. A large number of trials have been carried out to test the particular type of machinery suitable to the districts represented by the stations. Tashkent, for instance, has given special attention to "dry farming" implements and irrigation work.

During 1912 tests were made of (1) implements for the cultivation of grass land, (2) manure distributing machines, (3) the "Stripper," (4) maize harvesting and threshing machinery, (5) implements and machinery for "dry farming" districts, (6) European and Canadian harvesting machines, and (7) new machines.

Trials with motors and tractors, especially with those that may be adapted for drawing agricultural machinery and implements, form an important part of the work of the Bureau. A Laboratory has now been set aside for testing the material used in constructing the machines, and there is also a section for the construction of measuring instruments, such as an apparatus for determining the power of combustion motors and a grain-sorting machine.

The activities of the Bureau are not confined to machinery. Laboratories have now been installed for the study of soil physics and seeds, and such questions as the daily changes in the soil surface and the processes for drying grain are being investigated.

The Bureau issues from time to time bulletins dealing with the work accomplished.

Exhibition at Samarang, Java.—A Colonial Exhibition, the first of its kind promoted in the Dutch East Indies, is to be held at Samarang during the three months from August 13th, 1914. A section will be devoted to agriculture and horticulture. The Exhibition will be as far as possible of an international character, and steps are being taken to encourage representative exhibits from the various countries and colonies with which the Dutch East Indies have business relations.

State Assistance to Agriculture in Nova Scotia.—By a series of Acts passed in May, 1913, the Government of Nova Scotia is furthering the agricultural activities of the State in various ways. Annual grants

are to be made to the extent of £520 for the encouragement of poultry breeding, £1,040 for providing demonstration work in the growing of field crops, and £520 for promoting field crop competitions, seed fairs, and other measures calculated to encourage an increased production of high grade farm and garden seeds. In addition provision is made for a Superintendent of Dairying and a Provincial Entomologist

For the encouragement of poultry breeding, an association is to be formed to promote the holding of shows, and to arrange conferences among those interested in the industry. The annual grant is used to defray part of the expenses of the Association, to assist the local poultry clubs organised by the Association in holding shows, etc., and to pay the expenses of judges and instructors at the shows. Municipal authorities may also render financial assistance to their local clubs. The Association must submit an annual report to the Secretary of Agriculture

The Weather in England during December.

District	Temperature		Rainfall.			Bright Sunshine.	
	Daily Mean	Diff from Average	Amount	Diff from Average	Number of Days with Rain	Daily Mean	Diff. from Average.
Week ending Dec 6th	F	F	Inches	Inches		Hours	Hours
England, N E	42·0	+1·9	0·16	—0·39	2	1·5	+0·1
England, E	44·4	+4·6	0·28	—0·26	4	1·5	+0·1
Midland Counties	44·1	+4·5	0·69	+0·09	5	0·8	—0·5
England, S.E ...	47·5	+5·8	0·64	—0·07	5	0·8	—0·7
England, N W.	44·3	+2·8	1·33	+0·43	5	1·0	—0·2
England, S.W	47·8	+4·7	1·53	+0·37	6	0·5	—1·1
English Channel	49·8	+3·0	1·73	+0·67	6	0·4	—1·5
Week ending Dec 13th							
England, N.E.	43·7	+4·5	0·01	—0·57	1	0·9	—0·4
England, E. ...	44·4	+5·4	0·02	—0·44	1	1·2	—0·2
Midland Counties	44·9	+6·1	0·04	—0·50	2	0·7	—0·5
England, S.E.	46·0	+1·9	0·06	—0·54	2	0·9	—0·6
England, N W	45·9	+5·3	0·34	—0·45	4	0·5	—0·5
England, S W	47·7	+5·1	0·28	—0·78	4	0·8	—0·6
English Channel	50·2	+3·2	0·16	—0·77	4	1·1	—0·8
Week ending Dec. 20th							
England, N.E.	44·0	+5·5	0·07	—0·42	2	0·7	—0·5
England, E	42·5	+4·4	0·10	—0·25	3	1·2	—0·1
Midland Counties	42·2	+4·2	0·04	—0·42	1	0·8	—0·3
England, S E	42·1	+1·9	0·04	—0·44	1	2·3	+0·9
England, N W	43·9	+4·2	0·10	—0·55	2	0·6	—0·4
England, S.W. ...	42·7	+0·8	0·10	—0·81	2	2·0	+0·6
English Channel	45·8	+0·3	0·02	—0·72	1	1·5	—0·3
Week ending Dec 27th							
England, N E ..	38·8	+0·8	0·31	—0·09	3	1·0	—0·1
England, E .	38·1	+0·6	0·22	—0·17	3	1·1	—0·2
Midland Counties .	38·1	+0·7	0·32	—0·20	3	1·0	—0·2
England, S E. .	39·0	—0·6	0·84	+0·32	3	1·0	—0·4
England, N W. .	41·5	+2·2	0·94	+0·27	4	0·8	—0·2
England, S W. .	40·2	—1·2	1·20	+0·26	4	0·9	—0·5
English Channel .	44·3	—0·7	1·53	+0·76	4	1·8	—0·1

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for December, 1913, issued by the International Institute of Agriculture, shows the production of the cereal crops last year from information received up to December 15th. The countries for which it is possible to give an approximate estimate of the production are as follows:—In *Europe*: Germany, Austria, Hungary, Belgium, Denmark, Spain, France, Great Britain and Ireland, Italy, Luxemburg, Netherlands, Rumania, Russia in Europe (63 governments), Switzerland; in *America*: Canada, United States; in *Asia*: India, Japan, Russia in Asia (10 governments); in *Africa*: Algeria (excluding the Department of Algiers), Egypt, Tunis.

Wheat.—The total production in the above-mentioned countries (with the exception of Egypt) is estimated at 446,010,000 qr., as compared with 409,387,000 qr. in 1912, the increase being equal to 8 9 per cent. The area under crop showed an increase of 1.4 per cent.

Rye.—The estimated production in the specified countries (excluding Great Britain and Ireland, India, Japan, Algeria, Egypt, and Tunis) amounts to 213,266,000 qr., against 215,503,000 qr. last year, or a decrease of 1 0 per cent. The area planted, however, was greater than in 1912 by 1 4 per cent.

Barley—The production in the above countries (omitting India and Egypt) is placed at 182,858,000 qr, which is 7.7 per cent greater than in 1912, when the production was 169,840,000 qr. The area under crop was also greater by 4 4 per cent.

Oats—The production in the countries named above (with the exception of India and Egypt) is estimated at 468,631,000 qr, as compared with 458,046,000 qr in 1912, the increase amounting to 2 3 per cent The area showed an increase of 2 6 per cent

Maize—The total production in the specified countries (excluding Germany, Belgium, Denmark, France, Great Britain and Ireland, Luxemburg, Netherlands, India, and Algeria) amounts to 355,136,000 qr, against 433,074,000 qr. last year, or a decrease of 18 0 per cent. The area under crop decreased by only 0 5 per cent

The following supplementary notes are given—

Chili—A forecast of the cereal harvest of 1913-14 places the production of wheat at 1,498,000 qr, and of barley at 689,000 qr.

New Zealand—The area estimated as sown with wheat in 1913-14 is 167,000 acres, a decrease of 12.0 per cent as compared with the previous year Barley is estimated at 32,000 acres, a decrease of 14 6 per cent., oats at 362,000 acres, a decrease of 6 4 per cent; and maize at 6,000 acres, an increase of 28 1 per cent.

Sugar Beet.—The production in Prussia, Belgium, Denmark, Spain France, Hungary, Italy, Netherlands, Rumania, Russia in Europe (63 governments), Switzerland, Canada and the United States, is estimated at 49,109,000 tons, as compared with 47,918,000 tons in 1912, the increase being equal to 2 5 per cent. The area under crop, however, showed a reduction of 2 3 per cent

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United States.—The final official estimates of the yield of the crops of 1913 are as follows (in thousands of bushels, and 1912 figures in brackets):—Winter wheat, 523,561 (399,919); spring wheat, 239,819 (330,348); total wheat, 763,380 (730,267). Oats, 1,121,768 (1,418,337);

maize, 2,446,988 (3,124,746), barley, 178,189 (223,824); rye, 41,381 (35,664), buckwheat, 13,833 (19,249), flaxseed, 17,853 (28,073); potatoes, 331,525 (420,647); hay, 57,247,000 tons (64,903,000 tons); and sugar beet, 5,209,000 tons (4,664,000 tons)

A Report published by the Department of Agriculture on December 17th states that the area sown with wheat in the autumn of 1913 is estimated at 36,506,000 acres, or 8 6 per cent. greater than the estimated area sown in the autumn of 1912 The area under winter rye is estimated at 2,702,000 acres, or a decrease of 1 1 per cent The condition of winter wheat on December 1st was 97 2 per cent. (93.2 per cent on December 1st, 1912), and of winter rye 95 3 per cent (93 5 per cent.)

Australia.—The *Monthly Summary of Australian Statistics* of September, 1913, issued by the Commonwealth Bureau of Census and Statistics, gives the following estimates of the production of the principal crops in the Commonwealth, in the season 1912-13 (1911-12 figures in brackets) —Wheat, 91,981,070 bushels (71,636,347), oats, 16,116,712 bushels (9,561,771), maize, 8,356,158 bushels (9,039,855); and hay, 3,955,311 tons (2,868,032) The average yield per acre of wheat in 1912-13 was 12 53 bushels, compared with 9 64 bushels in 1911-12, of oats, 18 43 bushels, compared with 15 50 bushels, of maize, 26 53 bushels, compared with 26 58 bushels, and of hay, 1 22 tons, compared with 1 14 tons

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Live Stock in France.—The number of horses on December 31st, 1912, was 3,222,140, as compared with 3,236,110 at the same date in 1911, the decrease amounting to 0 4 per cent Cattle numbered 14,705,900, against 14,435,530, an increase of 1 9 per cent, sheep, 16,467,700, against 16,425,330, an increase of 0 3 per cent, and pigs, 6,903,750, against 6,719,570, an increase of 2 7 per cent (*Bulletin of Agricultural Statistics*, December, 1913)

Live Stock in the Union of South Africa.—The number of cattle, according to the census of 1911, was 5,796,949, against 3,500,453 in 1904, or an increase of 65 6 per cent Horses numbered 719,414, against 449,539, an increase of 60 0 per cent, sheep, 30,656,059, against 16,322,503, an increase of 87 8 per cent, and pigs, 1,081,600, against 679,084, an increase of 59 3 per cent (*Bulletin of Agricultural Statistics*, December, 1913)

Agricultural Conditions in England and Wales on January 1st.

The Crop Reporters of the Board, in reporting on the crops and agricultural conditions on January 1st, state that the mild and open December allowed of good progress being made with farm work, and cultivation is everywhere more forward than usual Over 85 per cent of the area intended for wheat this season has already been sown, and in many districts the proportion is fully nine-tenths At the same date last season, when little could be done in December, less than four-fifths had been seeded Wheat is everywhere very healthy and satisfactory, and the same may be said of all the other winter-sown corn oats, barley, and beans. In some places wheat was rather too forward, and the recent frost was welcomed as a useful check

Seeds are variable: they are satisfactory in the north, and generally so in the west, but in the south and east there are a good many failures as a result of the dry summer, and their prospects are not very promising.

About half the potato crop is generally considered to have been sold by this time, although the proportion varies greatly even in neighbouring districts From a few districts reports have been received of poor keeping quality

Turnips and swedes were generally lifted—where this practice is followed—in good condition They are generally of good quality although some reports state that they are not keeping very well; the roots are often small, but they often continued growing during December.

The condition of ewes is practically everywhere very satisfactory. Lambing has begun in a few of the earliest flocks Grass has generally been plentiful, and stock have thriven satisfactorily during the month.

Prevalence of Animal Diseases on the Continent

The following statement shows that according to the information in the possession of the Board on January 1st, 1914, certain diseases of animals existed in the countries specified —

Austria (on December 24th)

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 760 Hofe infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis

Belgium (for the period November 16th—30th).

Anthrax, Blackleg, Foot-and-Mouth Disease (163 outbreaks in 78 communes), Rabies

Bulgaria (for the period November 8th—16th)

Glanders, Sheep-pox, Sheep-scab.

Denmark (month of November)

Anthrax, Foot-and-Mouth Disease (1 outbreak), Glanders and Farcy, Swine Erysipelas, Swine Fever

France (for the period December 7th—13th)

Anthrax, Blackleg, Foot-and-Mouth Disease (653 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis

Germany (for the period December 1st—15th).

Foot-and-Mouth Disease (431 infected places in 140 parishes), Glanders and Farcy, Swine Fever

Holland (month of November)

Anthrax, Foot-and-Mouth Disease (2 outbreaks in 2 provinces), Foot-rot, Glanders, Swine Erysipelas

Hungary (on December 3rd).

Anthrax, Dourine, Foot-and-Mouth Disease (total of 2,442 "cours" infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period December 8th—14th).

Anthrax, Blackleg, Foot-and-Mouth Disease (1,097 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period August 15th—November 1st).
Anthrax, Foot-and-Mouth Disease, Glanders and Farcy.

Norway (month of November).
Anthrax, Blackleg, Swine Fever.

Rumania (for the period December 5th—13th).
Anthrax, Dourine, Foot-and-Mouth Disease (17,927 animals), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (month of August).
Anthrax, Foot-and Mouth Disease (37,797 animals in 379 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever

Servia (no further returns received).

Spain (month of October)
Anthrax, Dourine, Foot-and-Mouth Disease (38 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis

Sweden (month of November).
Anthrax, Blackleg, Swine Fever.

Switzerland (for the period December 15th—21st)
Anthrax, Blackleg, Foot-and-Mouth Disease (1,244 "étables," entailing 15,235 animals, of which 114 "étables" were declared infected during the period), Swine Fever.

Agricultural Labour in England and Wales during December.

The supply of agricultural labour in England and Wales during December was, according to statements in the Board's Monthly Agricultural Report (January 1st, 1914), generally sufficient for the time of year, although in various localities scattered throughout the country some deficiency was reported

Northern Counties—In *Northumberland, Durham, Cumberland* and *Westmorland* the supply proved generally equal to requirements, but a shortage of temporary labour for turnip lifting was experienced in south-west *Northumberland* and in parts of north and south-west *Durham* In east *Durham* there was a good demand for young women on dairy farms. The supply of labour in *Lancashire* and *Cheshire* was sufficient in nearly all districts. It was, however, reported as being short in east *Lancashire*, and good labour was scarce in east *Cheshire*, though there was a sufficiency of inferior men Labour was generally sufficient or even plentiful in *Yorkshire*, except in a few districts of the *West Riding*.

Midland Counties—Although somewhat deficient in places, the supply of labour was, on the whole, about equal to the demand In some parts of *Staffordshire* a scarcity was still reported

Eastern Counties.—The supply of labour was generally quite sufficient to meet the demand. In north-east *Lincolnshire* and east *Holland*, however, a shortage of young men was complained of, and in west *Holland* there was a scarcity of temporary help, while in *Huntingdonshire* labour was said to be gradually getting more difficult to obtain In *Suffolk* and *Cambridgeshire* a surplus of labour was occasionally experienced.

Western Counties—The supply of labour was sufficient throughout this division, except in north *Worcestershire*, where it was said to be scarce.

South-Western Counties.—The supply was generally sufficient for the present requirements, but a few reports speak of a deficiency of skilled labour near the towns. In south and west *Devon* and south-west *Cornwall* the supply was deficient.

South-Eastern Counties.—The supply of labour was generally sufficient, except in south-east *Hertfordshire*, where a dearth of good men was experienced.

Wales.—As a rule the supply was sufficient, but in several districts some scarcity was reported.

THE CORN MARKETS IN DECEMBER.

C. KAINS-JACKSON.

British Wheat.—Farmers sent wheat to market somewhat more freely than in December, 1912, but not so freely as in December, 1911. On the whole the supply at the statute markets was not at all excessive, but the mild weather of the first 24 days of the month created an impression that grain was difficult to place. Despite holidays, the last seven days of the month witnessed more buying, but a good deal of this was done off the markets. The telephone's extended use is affecting business by spreading it over all the week where it was formerly confined to market days. Prices showed a slight recovery from the final values of November, and the year closed with quotations as good as those of December, 1912, and better than the exceptionally low rates accepted during a brief wave of depression in the last fortnight of that year. Farmers attending Mark Lane expressed satisfaction that values kept above 30*s*.; they urged, however, that increased expenditure made the 30*s* level by no means the trustworthy datum line that it was at the commencement of the new century. A certain small but steady demand for seed corn, however, showed that with favourable weather wheat continued to be sown. Stand-up kinds, Red Standard and Burgoyne's Fife sold well for seed use in the south, and Browick in the north.

Colonial and Indian Wheat.—The Canadian wheat surplus continues to be pressed on sale, and the automatic rise in freights which occurs on December 1st has failed to check shipments. Opinion is divided as to whether the Canadian farmers are reduced to selling at little or no profit or are, at a 37*s* to 40*s* level, making such large gains that with value reduced by 4*s* they can still make money. The price of Manitoba wheat on New Year's Eve was 35*s* 6*d* per quarter for the grain ex ship off Tilbury, and 7*s*. 2*d*. per cental ex ship in the Mersey. The price was 2*d*. per cental below that of best grade winter wheat and 3*d* below that of American Red—a reversal of usual positions which is likely to be remembered as one of the features of the year. Indian wheat was very firm all through the month, and in London the final price was 38*s* per 492 lb paid for Best White. The Australian wheat of the January, 1913, crop was scarce and commanded a good price, but the new crop of January, 1914, was offered for prompt shipment at 35*s*. 6*d*. per 480 lb.

Foreign Wheat.—These sorts have been held rather steadily. Russian has been by no means plentiful, despite free exports, the

Continent taking the great majority of cargoes American Winter has been undersold by Canadian Spring, and American Spring has been under average in supply. Argentine old crop was nearly exhausted before December came in, and the new crop, though offered freely for January shipment at 34*s* per 480 lb, cannot be here in any quantity before March. The year closed with North Russian at 36*s* per 492 lb., South Russian at 34*s*. for clean and good grain, Old Bahia Blanca 7*s* 5*d* per cental, ricey Rosario 6*s* 10*d* only, New Duluth No. 1 7*s*. 1*d* per cental, while fine No 1 California, and the best Chilian wheat were top of the market with 7*s* 7*d* per cental, paid at Liverpool on the 30th.

Wheat Supplies and Shipments—The imports of December showed a reduction on those of November, and in no week reached over half a million quarters Thus the Exchanges were given some chance of regaining steadiness, and had the temperature been that of an ordinary December they would probably have done so The closing days of December brought to the Thames a welcome cargo of old Australian wheat The grain arriving from Germany, an importing country, is largely Polish, which cuts across East Prussia on its way to the nearest port There is even some Galician Nevertheless, some part of the receipts from the German Baltic have included Danzig and Pomeranian, which millers value for strength without excessive hardness This is our very oldest import trade in wheat, and a century ago used to head the weekly quotations at Mark Lane Shipments for December were 1,362,000 qrs from North America, 74,000 qrs from South America, 155,000 qrs from India, 1,976,000 qrs from Russia, 704,000 qrs from Europe S E., and 132,000 qrs from Australia The supply on passage was 1,470,000 qrs on 31st as compared with 1,760,000 qrs a year previously. Stocks at the 15 chief ports were reckoned about half a million quarters less than on December 31st, 1912

Flour—Flour lost ground steadily, until the frost, at the very close of the month, steadied markets, and the old year ended with Top-Price at 31*s* 6*d*, Town Whites at 29*s* 6*d*, fine American, London ground, at 28*s* 6*d*., Standard 80 per cent at 27*s*, Town Households at 26*s* 6*d*, good Country Patents at 26*s*, American First Bakers' at 25*s* 3*d*, and Country Roller Whites at 24*s*, all per 240-lb sack The North American shipments were 485,000 sacks, and the 31st saw 212,000 sacks on passage. A touch of frost distinctly helped trade after Christmas

Barley—The average price on the country markets fell over a shilling on the month, and closed nearly three shillings cheaper on the year Great depression marked nearly all the country markets For the week ended December 23rd London showed the low average of 27*s* 3*d* Several of the market reports and circulars gave 24*s* as the lowest price There is hope of a better demand for malting quality with colder weather, and it is believed that fine grain has been held back, the October and November bids not satisfying growers The farmers who aim at fine malting quality and " a good Burton market " are mostly men of means who can afford to hold. Imported barley has fallen 1*s* for Californian, which closed at 35*s* 6*d* for No 1, and 33*s* 6*d* for No. 2 Chilian was so scarce that quotations were hardly feasible The last sale noted was at Liverpool on the 16th, when 34*s* was realised Russian feeding barley has averaged a guinea per 400 lb, and Indian 27*s*, the latter having been very scarce indeed Shipments for December were 151,000 qrs from North America, 1,685,000 qrs from Russia, 502,000 qrs.

from Europe S E , and 4,000 qrs. from India On the 31st there were 200,000 qrs. on passage from Pacific ports, 30,000 from Indian, 120,000 from the Black Sea, and 10,000 from the Mediteranean. In all 360,000 qrs. were on passage as compared with 720,000 qrs. a year previously.

Oats —The price of British oats, which increased in November, was fairly maintained in December, and the cold spell from the 27th to the 31st made the resumption of business after Christmas fairly good. The imports for the first four months of the cereal year were much less than usual and, on the inland exchanges, there was a general expectation of higher prices by February. The ports were less confident, as La Plata's new crop was freely offered for January shipment at 15*s* and Rumania was actually shipping at that price. There were, however, only 150,000 qrs on passage from all sources. December shipments were 455,000 qrs from Russia, and 264,000 qrs from Europe S.E. New World shipments were quite trivial

Maize —Five shillings per cental has remained the wholesale cash price all through December This has been quite the steadiest branch of the corn market The demand at this price has been large, despite the open weather which prevailed up to the 24th. Imports for the period September 1st–December 31st were about 4½ million quarters, which is at the rate of 13½ millions yearly. The shipments of December were 1,148,000 qrs from Argentina, 430,000 qrs from the Black Sea, and about 50,000 qrs from all other ports, including Salonica, Rangoon and Antwerp, the latter, of course, a re-shipper. There were on the 31st 660,000 qrs. on passage as compared with 1,040,000 qrs a year previously. The new crop of the U.S was not quoted for New Year shipment, an occurrence without precedent for many years

Oilseeds —Indian and Russian sorts of linseed have tended to rise, but La Plata has continued to offer excellent seed at 44*s*. per 416 lb. arrived cargoes, at our ports Linseed oil is cheap at 25*s* 6*d* per cwt , and linseed cake at 7*s* 9*d* per cwt is a boon to those who a year ago were forced to pay 8*s* 3*d*. These prices are for English make Russian cake is arriving at the really low price of £7 7*s*. 6*d* per ton Value had been firm for cottonseed till Christmas, but closed at 8*s*. 9*d* per cwt. for Egyptian

Various —Cheap potatoes have tended to weaken the demand for bread, and very cheap beet sugar has had a similar depressing influence on feeding stuffs Rice at 7*s* 9*d* per cwt for feeding type is now cheap, while haricot beans from Burma are also offered at a lower price than usual, 38*s* 6*d* per 504 lb being accepted.

THE LIVE AND DEAD MEAT TRADE IN DECEMBER.

A. T. MATTHEWS.

Fat Cattle —Supplies of fat cattle in most of the English markets were well maintained during December, and, although the numbers at the Christmas markets were generally rather below those of 1912,

they show an increase on the average of the corresponding sales of the last three years. In view of the known facts relating to the cattle population of the country, this can only be accounted for by the exceptionally good grazing conditions of the past autumn, which brought into good condition many cattle which in ordinary seasons would have had to be wintered. There has also been an unusual run on the younger cattle, very large numbers of two-year-olds being included in the supplies, farmers being apparently anxious to realize at the comparatively good prices prevailing. The Christmas markets generally, and certainly the Islington market, showed this feature very clearly, and, whether intentionally or otherwise, responded to the increasing demand for cattle of medium size in moderately fat condition. Average prices have been very steady from week to week, the advance shown as compared with November prices being no larger than would be accounted for by the extra rates which almost always prevail at the Christmas markets. Shorthorns averaged 8*s*. 11*d*. and 8*s*. 1*d*. per 14-lb. stone for first and second quality respectively, against 8*s*. 9*d* and 7*s*. 11*d*. in November; Herefords, 9*s* and 8*s* 5*d*., against 8*s*. 11*d* and 8*s* 4*d*.; Devons, 9*s*. and 8*s*. 4*d*., against 8*s* 11*d* and 8*s*. 1*d*; Welsh Runts, 8*s*. 9*d*. and 8*s*. 1*d*, against 8*s*. 8*d*. and 8*s*.; and Polled Scots, 9*s*. 3*d*. and 8*s*. 7*d*., against 9*s*. and 8*s* 6*d* per stone. Stall-fed Norfolk Shorthorns at the Metropolitan market, as usual, sold well.

Veal Calves—For the first three weeks of the month calves came forward sparingly and sold at the high average, in English markets, of 9½*d*. and 8½*d* per lb., for first and second quality respectively In the fourth week there was some decline, but prices were much higher than in 1912 at the same date

Fat Sheep—The trade for sheep continued to harden, and prices again steadily advanced As an index of the position towards the end of December it may be remarked that, contrary to the general rule, there was a sharp advance in prices at the Metropolitan market just before Christmas. Trade for mutton is almost always dull at that period, but, this year, the 6,880 sheep on offer were easily disposed of at the highest prices recorded for many years On the 15th Southdowns realised as much as 7*s*. 6*d*. per 8-lb stone, and Hampshires and Suffolks up to 7*s*. 2*d*., while on the 29th 7*s* 4*d* was occasionally paid. In about 23 English markets held in December Downs averaged 10*d* per lb. for first, 9¼*d*. for second, and 7½*d* for third quality, against 9¾*d*., 8¾*d*., and 7¼*d*. in November. Longwools averaged 9¾*d*, 8¾*d*., and 7*d*., against 9½*d*., 8½*d*., and 6¾*d*.; Cheviots of first quality, 10¼*d*. against 10*d*.; and Cross-breds, 10*d*. against 9¾*d* At the Christmas markets the prices realized at Islington were the highest with the exception of Newcastle and Peterborough, where 10¾*d* per lb was also recorded. At Hull in the same week Lincoln Longwools again realized 10¼*d* per lb.

Fat Lambs.—A few pens of Dorset Horn lambs were on offer at the Islington great market, and were sold at 1*s*. 0¼*d*. and 1*s*. per lb., but there was not much demand for them.

Fat Pigs.—There has been another small decline in the pig trade. Prices were only slightly higher than a year ago, and were 6*d*. per stone less than the highest figure reached in the summer and autumn The December averages in English markets were 8*s* 2*d*. and 7*s*. 9*d*. per 14-lb. stone, against 8*s*. 3*d*. and 7*s*. 10*d*. in November.

Carcass Beef—British.—Trade in Scotch and English beef was singularly dull during the first half of the month, Scotch whole sides making only 4*s*. 2*d*. to 4*s*. 4*d*. per 8-lb. stone, and English, 4*s*. to 4*s* 2*d*. By the 17th there was a slight advance, but some apprehension prevailed in the Smithfield market regarding the disposal of the Christmas supplies. Considerable relief was therefore felt when by the 23rd it was seen that there would be a fair clearance at 4*s*. 10*d* to 5*s*. 2*d*. for Scotch short sides, and 4*s*. 6*d*. to 4*s*. 8*d*. for long sides. English finished at 4*s*. 2*d*. to 4*s*. 4*d*. No Canadian beef has been on offer, nor any Irish till the last week, when a few sides realized 4*s*. 1*d*. to 4*s*. 3*d*. per stone.

Chilled Beef.—Argentine chilled hind quarters began the month at 3*s*. 2*d*. to 3*s*. 6*d*, advancing a little each week till a day or two before Christmas they touched 4*s*., but dropped to 3*s*. 6*d*. in the following week. Fore quarters have again been relatively high, fetching as much as 2*s*. 10*d*. per stone.

Frozen Beef—Dealers in "hard" beef appeared to be holding their stocks very firmly at rather high rates Very little business has been done and quotations have on occasion really been almost nominal. They have stood uniformly throughout at 2*s*. 10*d*. to 3*s*. for hind quarters, and 2*s*. 6*d*. to 2*s*. 8*d*. for fores.

Carcass Mutton—Fresh Killed.—Scotch and English mutton has been firm but quiet, with very little fluctuation in prices. Scotch has averaged 5*s* 6*d* per stone for first, and 5*s* 2*d*. for second quality. Exceptionally small carcasses have often made 5*s* 8*d*, but these have not been very numerous. English have sold at 5*s*. to 5*s*. 4*d*., a very low price in proportion to the value of live tegs at Islington.

Frozen Mutton.—Frozen mutton has been in good, steady demand at rather more money than was made in November. New Zealand averaged 3*s*. 5*d*. and 2*s*. 11*d*. per 8 lb., an advance of ½*d*. per lb. on the month. Australian has been worth 2*s*. 7*d*. to 3*s*., and Argentine 2*s*. 8*d*. to 2*s*. 11*d* per stone

Frozen Lamb—This article has been in good demand for the time of year, and prices advanced in December, although there has been a supply of new-season produce from all three of the usual sources. New Zealand has fetched from 3*s*. 10*d*. to 4*s*. 3*d*. per stone all the month, and Argentine and Australian only about 1*d* per 8-lb. less money.

Veal.—Supplies having been moderate, and at times very light, the best English easily made 5*s*. 4*d*., and Dutch 5*s* 8*d*, per stone. At the end of the month veal was so scarce that English sold at 5*s*. 4*d*. to 6*s*., and the finest Dutch at 6*s*. 4*d*. or even 6*s*. 8*d* per stone.

Pork.—A good demand continued at steady prices, the dearest week being that before Christmas English averaged 5*s*. 1*d*. and 4*s*. 9*d*. per stone, and Dutch 4*d* less money. At the end of December fat sows were fetching about 6*d*. per lb in the Central Market.

THE PROVISION TRADE IN DECEMBER.

HEDLEY STEVENS.

Bacon.—Although the consumptive demand for bacon was good throughout December, especially towards the end of the month, prices on the whole have been easier, chiefly owing to the heavy arrivals from Denmark, with a large proportion of fat and heavy sides, necessitating all-round reductions in prices to prevent accumulations prior to the holidays.

For the week ending December 13th, the number of pigs killed in Denmark constituted a record, causing English buyers to act very cautiously, as it is feared that on arrival of the cured product, further reductions will take place.

The American markets remain very firm, and demand prices for shipment which British importers refuse to pay, continental meats being proportionately cheaper.

The arrivals of hogs at the packing centres have continued more free, but prices have not fallen proportionately, as apparently the demand for the raw material is keen.

At Chicago during the month prices for hogs ranged from $7.25 to $8.05, against $6.85 to $7.85 last year, and $5 40 to $6.60 two years ago.

There was a good demand for English and Irish pigs during the month.

Cheese.—There was more business during December, and values had a hardening tendency, but at the prevailing high level of prices dealers act very cautiously.

The actual figures of shipments from Montreal and Quebec for the season of 1913 are now available, showing a shortage in the number of cheese shipped compared with last year of 143,449, and 260,753 less than in 1911.

Although larger arrivals are expected from New Zealand, it is felt that the shortage in Canadian supplies must cause prices to advance steadily between now and the end of April, when the new season commences Further, the stocks stored in Canada are considerably below the average, and are held for high prices

The arrivals from New Zealand were fair, but will be much larger in January, as some shipments delayed through labour difficulties will then arrive. Quality is good and prices ranged within 1*s*. to 2*s*. per cwt. of best Canadians, and if future arrivals maintain the same standard the demand for this description will increase, decreasing the demand for Canadians.

Estimated stocks of Canadian cheese at the three distributing centres (London, Liverpool, and Bristol), at the end of the month were 224,167, against 309,239 at the same time last year, and 262,840 two years ago.

Estimated stocks of New Zealand cheese in London were 7,000 crates (two cheese in each), against 16,500 crates in December, 1912, and 2,500 two years ago.

English cheese continued in good demand at satisfactory prices. Loaf cheese was scarce, and commanded relatively high figures.

Butter.—The general provincial demand throughout the month was somewhat disappointing.

The London market experienced a fair trade, especially for best grades, but with larger arrivals the high prices of November were not maintained: in November first grade New Zealand realized as high as 130*s* per cwt., but by the end of December could be purchased at 120*s*.

The arrivals from both Australia and New Zealand will be much larger during January, 385,000 boxes, say 9,625 tons, being then due to land in this country from those Colonies, and it is confidently expected that prices must recede several shillings by the middle of the month.

The consumptive demand for second grades continued disappointing, but was larger than during November, and prices were irregular.

Canadian and American prices continued high, and it is not possible for any further shipments to England from those countries this season, but should prices continue to fall in England we may export to America some further Siberian and Australian butters.

Best Irish creameries were very scarce, but there were free offerings of factory makes *ex* cold stores at irregular prices.

The Canadian shipments of butter from Montreal for the season just closed amounted to 1,728 packages, against 70 last year, and 135,215 in 1911.

Unit Prices of Artificial Manures.

Statement of cost to the purchaser of 1 per cent per ton of Nitrogen, Soluble and Insoluble Phosphates, and Potash derived from

	Bristol.	Hull.	King's Lynn.	Liverpool.
	s. d.	s. d.	s. d.	s. d.
Nitrogen from:				
Sulphate of Ammonia 95% pure .	14 2	14 0	14 0	13 4 (93% pure.)
Calcium Cyanamide ...	11 10	11 10	12 2	11 10
Nitrate of Soda pure . 95%	15 5	14 5	14 6	–
... 90%	—	—	–	13 6½
Nitrate of Lime	15 7	15 3	15 9	—
Soluble Phosphates from:				
Superphosphate 35%	1 9½	1 9½	1 7	1 9½
,, 33%	1 10	1 9½	—	1 9½
,, 30%	1 10	1 9½	1 8	1 9½
,, 26%	2 0	1 11	1 9	1 11
Dissolved Bones	2 7	2 5	2 6	2 6
Allowed for Nitrogen	*18 5*	*17 5*	*17 3*	*18 3*
Allowed for Insol Phos	*1 11*	*1 10*	*1 6*	*1 11*
Insoluble Phosphates from:				
Basic Slag	1 8	1 5	—	1 3
Bone Meal	1 5	1 5	1 6	1 6½
Allowed for Nitrogen	*13 8*	*14 0*	*15 9*	*14 7*
Steamed Bone Flour ..	1 4½	1 5	1 7	—
Allowed for Nitrogen	*13 5*	*13 4*	*15 0*	—
Potash from:				
Kainit	4 4½	3 11½	3 11	4 4½
Sulphate of Potash ...	4 10	4 4	4 5	4 5½
Muriate of Potash ...	4 2	3 9	3 8	3 8½
Potash Salts	—	3 3	—	—

NOTE.—These unit prices are based on the probable retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified. They are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the per-

various sources, at certain Ports and Manufacturing Centres, for January, 1914.

London.	Newcastle.	Newport.	Plymouth.	Silloth	Widnes.
s. d	*s. d*	*s. d*	*s d*	*s. d.*	*s d.*
13 5	13 7	14 1	14 2½	13 8	13 5 93% pure.
11 10	—	11 11	11 10	—	—
15 0	15 3	15 10	15 7	15 3	13 8
—	—	—	—	—	—
15 10	—	16 1	15 6	—	—
1 8	1 11	1 10	1 10	1 10½	1 8½
1 8½	—	1 10½	1 10½	—	1 8½
1 8½	1 11	1 10½	1 10½	1 11	1 8½
1 10	2 1	2 0	2 0	2 1	1 10
2 6	2 6	2 7	2 8	2 6	2 6
18 3	*17 7*	*18 7*	*18 10*	*17 7*	*18 3*
1 10	*1 10*	*2 0*	*2 0*	*1 10*	*1 11*
1 6	1 4	1 4½	1 7½	—	—
1 7½	1 6	1 6	1 7	—	1 6½
15 9	*14 9*	*13 7*	*15 7*	—	*14 11*
1 4	1 5	1 3	1 5	—	—
12 10	*13 8*	*13 2*	*13 10*	—	—
4 1	4 3½	4 4½	4 4½	4 4	4 4½
4 8	—	4 11	4 10	4 10	4 7
3 11	—	4 0	4 4½	4 0	—
—	—	—	—	3 3½	—

centages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and re-bagging the ingredients, bags, and loss of weight.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in December and November, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description	December. First Quality	December. Second Quality	November. First Quality	November. Second Quality.
FAT STOCK :—	per stone *	per stone *	per stone *	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 3	8 7	9 0	8 6
Herefords	9 0	8 5	8 11	8 4
Shorthorns . .	8 11	8 1	8 9	7 11
Devons ..	9 0	8 4	8 11	8 1
Welsh Runts	8 9	8 1	8 8	8 0
	per lb *	per lb *	per lb *	per lb *
	d.	d.	d.	d.
Veal Calves	9½	8¼	9¼	8¼
Sheep :				
Downs ..	10	9¼	9¾	8¾
Longwools ...	9¾	8¾	9½	8½
Cheviots	10½	9¼	10	9¼
Blackfaced . ..	10¼	9¼	9¼	8½
Welsh	9¾	8½	9¼	8¼
Cross-breds	10	9	9¾	8¾
	per stone *	per stone *	per stone *	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs ...	8 3	7 10	8 4	7 10
Porkers	9 2	8 8	9 0	8 7
LEAN STOCK :	per head	per head	per head	per head
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk	24 9	20 10	24 3	20 9
,, —Calvers .	24 13	20 11	23 9	20 1
Other Breeds—In Milk .	21 1	18 4	20 11	17 12
,, —Calvers	—	16 0	—	15 10
Calves for Rearing ..	2 12	1 19	2 10	1 19
Store Cattle :—				
Shorthorns—Yearlings ...	11 10	10 1	11 10	9 19
,, —Two-year-olds	14 19	13 7	15 11	13 8
,, —Three-year-olds	18 15	16 12	19 2	16 14
Herefords —Two-year-olds .	17 8	14 10	17 2	14 18
Devons— ,,	15 16	13 11	15 16	13 18
Welsh Runts— ,,	15 5	13 0	15 10	13 6
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	46 8	40 3	43 8	38 1
Store Pigs :—				
8 to 12 weeks old	25 9	19 4	25 7	19 4
12 to 16 weeks old	38 4	29 8	37 4	28 6

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in December, 1913.

(Compiled from Reports received from the Board's Market Reporters)

Description	Quality	Birmingham	Leeds	Liverpool	London	Manchester
		per cwt s d	per cwt s d	per cwt s. d	per cwt s. d.	per cwt. s d.
BEEF.—						
English	1st	59 0	58 0	56 6	60 0	57 0
	2nd	56 0	55 6	51 0	58 0	52 0
Cow and Bull	1st	51 0	54 0	48 0	48 6	48 6
	2nd	45 6	49 0	40 6	45 0	43 0
Irish Port killed	1st	—	55 6	56 6	59 6	—
	2nd	—	53 6	51 6	57 0	—
Argentine Frozen—						
Hind Quarters	1st	45 6	44 6	44 6	42 0	44 6
Fore „	1st	39 6	39 0	39 0	37 6	39 0
Argentine Chilled—						
Hind Quarters	1st	51 6	49 0	48 0	51 0	48 0
Fore „	1st	39 6	38 6	37 6	38 6	38 0
Australian Frozen—						
Hind Quarters	1st	42 6	41 6	42 0	42 0	42 0
Fore „	1st	39 6	38 6	37 6	37 6	37 6
VEAL.—						
British	1st	—	75 6	83 0	77 6	81 6
	2nd	72 0	71 0	75 6	68 0	75 6
Foreign	1st	—	—	—	82 0	—
MUTTON.—						
Scotch	1st	—	—	82 0	77 0	83 0
	2nd	—	—	77 0	72 6	78 6
English	1st	77 6	79 6	78 0	74 0	79 0
	2nd	68 6	75 0	73 0	69 6	73 6
Irish: Port killed	1st	73 6	—	77 0		—
	2nd	65 6	—	72 6	—	—
Argentine Frozen	1st	40 6	41 6	39 6	41 6	40 6
Australian „	1st	39 6	38 6	39 6	41 6	39 6
New Zealand „	1st	—	—	—	48 6	—
LAMB:—						
British	1st	—	—	—	—	—
	2nd	—	—	—	—	—
New Zealand	1st	59 6	58 0	52 6	58 0	52 6
Australian	1st	56 0	55 0	52 6	56 6	52 6
Argentine	1st	54 6	52 6	51 6	56 6	56 0
PORK:—						
British	1st	83 0	76 6	82 6	71 6	82 0
	2nd	75 0	73 6	76 6	66 6	76 6
Foreign	1st	—	—	—	67 0	—

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1911, 1912 and 1913.

Weeks ended in 1913).	WHEAT. 1911	WHEAT. 1912.	WHEAT. 1913	BARLEY. 1911.	BARLEY. 1912	BARLEY. 1913	OATS. 1911.	OATS. 1912.	OATS. 1913.
	s. d.	s. d	s d	s. d.	s d.	s. d.	s. d.	s. d.	s. d.
Jan. 4...	30 5	33 2	30 5	23 11	33 3	28 6	17 0	20 7	19 10
,, 11...	30 8	33 1	30 3	23 10	33 0	28 4	17 2	20 8	19 2
,, 18...	30 11	33 4	30 5	24 4	33 3	28 6	17 4	20 11	19 4
,, 25...	30 11	33 7	30 11	24 5	33 1	28 10	17 3	21 1	19 4
Feb. 1 .	30 9	33 8	31 1	24 5	32 10	28 11	17 5	21 3	20 2
,, 8...	30 5	34 0	31 0	24 6	33 2	28 10	17 5	21 4	20 1
,, 15	30 3	34 4	30 9	24 7	32 10	29 1	17 6	21 7	20 2
,, 22...	30 2	34 6	30 11	24 9	32 8	28 8	17 7	21 9	20 7
Mar 1 .	30 0	34 1	31 0	25 0	32 0	28 6	17 5	21 6	20 4
,, 8...	30 1	34 1	31 3	25 0	31 7	28 5	17 5	21 8	20 0
,, 15 .	30 1	34 0	31 1	24 11	31 2	27 11	17 6	21 8	20 2
,, 22	30 2	34 1	31 1	25 0	31 10	28 6	17 5	21 9	19 11
,, 29	30 3	34 4	31 3	24 11	30 3	27 6	17 5	21 8	19 7
Apl 5..	30 4	34 10	31 4	24 7	30 9	27 0	17 7	21 11	19 2
,, 12...	30 3	35 4	31 3	25 2	30 2	27 8	18 3	22 1	19 2
,, 19...	30 4	36 7	31 6	25 5	29 11	26 11	17 10	22 4	18 10
,, 26...	30 11	37 10	31 8	25 5	30 4	26 7	18 3	22 9	19 3
May 3..	31 4	38 1	32 2	25 7	30 2	25 11	18 6	23 1	19 6
,, 10...	31 8	37 11	32 6	25 1	31 1	25 9	19 0	23 7	19 6
,, 17 ..	32 6	37 8	32 10	25 4	31 2	25 4	19 2	23 7	19 9
,, 24 .	32 8	37 2	32 10	25 0	31 1	25 3	19 5	23 7	19 11
,, 31..	32 5	36 10	32 7	24 10	30 0	26 1	19 5	23 9	20 1
June 7...	32 4	36 11	32 10	25 7	29 11	26 2	19 7	24 0	19 8
,, 14...	32 3	37 0	32 8	23 11	30 8	24 7	19 8	23 10	20 2
,, 21 .	31 11	37 5	32 8	23 9	30 8	23 10	19 10	24 0	19 8
,, 28..	31 10	37 10	32 8	24 5	30 2	24 3	19 9	23 11	19 1
July 5...	32 1	38 2	33 1	25 10	31 7	25 2	19 9	23 11	21 0
,, 12 ..	32 3	38 3	33 4	25 10	30 2	25 10	19 11	24 1	19 4
,, 19	32 5	38 10	33 6	24 3	30 9	24 9	19 5	24 8	20 5
,, 26 .	32 5	38 9	33 10	23 8	30 9	24 1	19 7	23 4	20 8
Aug. 2..	32 0	38 4	34 1	24 4	28 6	24 5	18 2	22 2	20 3
,, 9...	31 6	39 2	34 1	26 9	30 7	24 9	18 0	22 4	19 0
,, 16...	31 6	38 2	34 3	27 8	28 3	24 7	17 10	21 8	18 7
,, 23...	31 8	35 6	33 7	28 10	28 1	26 5	18 0	20 10	18 8
,, 30...	31 7	34 10	32 7	28 4	28 6	29 0	18 3	20 8	17 10
Sept 6...	31 10	35 1	31 11	28 4	29 9	30 11	18 1	21 8	17 8
,, 13...	32 0	33 5	31 9	29 0	29 0	31 5	18 5	20 5	18 0
,, 20..	32 4	32 7	31 7	29 11	29 6	30 9	18 9	19 10	17 11
,, 27...	32 6	31 7	31 6	30 5	29 9	30 1	19 1	19 5	17 9
Oct. 4	32 7	31 8	31 3	30 9	29 7	29 9	19 5	19 8	17 10
,, 11	32 9	31 10	31 0	31 0	30 4	29 1	19 10	19 5	17 10
,, 18..	32 9	32 2	30 11	31 5	30 11	28 8	19 11	19 9	17 9
,, 25	33 1	33 1	30 7	31 7	31 6	28 7	20 6	19 10	18 0
Nov 1...	33 4	33 4	30 1	31 10	31 10	28 2	20 8	20 1	17 9
,, 8..	33 4	33 1	30 0	32 7	31 11	28 1	20 11	19 11	17 9
,, 15 .	33 1	32 10	30 1	32 10	31 2	27 8	21 0	19 9	17 11
,, 22..	33 0	32 1	30 4	33 5	30 11	27 5	20 10	19 11	18 1
,, 29	32 10	31 9	30 9	33 10	30 8	27 0	20 11	19 8	18 4
Dec 6	32 9	31 0	31 2	34 0	29 11	26 8	20 9	19 6	18 4
,, 13 .	32 11	30 8	31 2	33 5	29 2	26 5	20 9	19 3	18 6
,, 20.	32 9	30 7	31 2	33 5	28 11	25 11	20 8	19 1	18 5
,, 27...	33 0	29 10	31 0	33 4	28 6	25 10	20 7	19 2	18 4

NOTE. Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb; Oats, 39 lb. per Imperial Bushel.

CORN PRICES:—ANNUAL AVERAGES.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Weekly Averages of Corn Returns from the Returning Markets, together with the QUANTITIES returned as sold at such Markets during each of the Years 1907 to 1913.

YEARS.	PRICES.			QUANTITIES.		
	Wheat.	Barley.	Oats.	Wheat.	Barley.	Oats.
	s. d.	s d.	s. d.	Quarters.	Quarters.	Quarters.
1907.. ..	30 7	25 1	18 10	2,722,847	3,317,521	1,374,260
1908.. .	32 0	25 10	17 10	3,293,506	3,293,916	1,304,223
1909 . ..	36 11	26 10	18 11	2,641,225	2,699,628	905,983
1910. ..	31 8	23 1	17 4	3,072,523	3,205,203	791,121
1911 .	31 8	27 3	18 10	3,140,257	3,123,986	858,341
1912.. ..	34 9	30 8	21 6	2,365,596	2,165,572	630,755
1913 .	31 8	27 3	19 1	2,511,297	2,948,930	639,298

AVERAGE VALUE per IMPERIAL QUARTER OF WHEAT IMPORTED into the UNITED KINGDOM from the under-mentioned Foreign Countries and British Possesions in the Years 1911, 1912, and 1913.

Countries from which consigned.	Average Value per Imperial Quarter.		
	1911.	1912.	1913.
	s d	s d.	s. d.
Argentine Republic	33 4	35 6	35 7
Bulgaria	35 1	36 4	—
Chile	33 0	36 9	36 7
Germany	33 6	36 8	31 0
Persia	34 6	37 0	—
Rumania	34 7	37 3	33 3
Russia	33 4	37 6	33 11
Turkey	27 3	35 8	23 6
U.S. of America	34 9	35 9	35 1
Australia	34 10	38 5	37 6
British East Indies	33 7	37 0	36 6
Canada	34 10	35 2	34 8
New Zealand	32 11	37 4	35 5

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

—		Wheat. 1912	Wheat. 1913	Barley. 1912.	Barley. 1913	Oats. 1912.	Oats. 1913
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	November ..	47 1	45 2	30 5	28 7	24 1	22 4
	December ..	46 9	45 2	30 3	28 5	23 10	22 3
Paris:	November .	49 1	45 8	31 5	29 9	24 9	21 10
	December ..	48 4	45 5	31 5	29 7	24 4	21 8
Belgium	October ..	35 8	32 4	30 10	26 3	25 2	20 5
	November	35 1	32 3	31 2	26 0	24 3	20 5
Berlin:	October ..	45 4	39 9	—	—	26 0	21 11
	November .	44 1	39 10		—	25 5	21 8
Breslau:	October	40 8	40 10	32 5* 28 10†	27 9* 25 7†	27 8	21 6
	November .	39 11	39 5	32 4* 28 5†	28 3* 25 7†	23 8	21 1

* Brewing † Other

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*, the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of December, 1912 and 1913.

—	Wheat. 1912.	Wheat. 1913	Barley. 1912	Barley. 1913	Oats. 1912.	Oats. 1913
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London	31 1	32 2	29 2	27 6	20 4	20 5
Norwich	32 4	30 11	27 0	25 5	19 9	18 1
Peterborough . ..	27 4	30 9	26 8	26 0	16 10	17 7
Lincoln	27 11	31 8	30 1	26 6	18 11	18 2
Doncaster	28 6	31 2	30 1	26 2	19 1	18 7
Salisbury .	30 7	30 5	30 9	26 8	18 11	19 0

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in December, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality	Second Quality	First Quality	Second Quality	First Quality	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb	per 12 lb	per 12 lb.	per 12 lb	per 12 lb	per 12 lb
British	15 6	14 0	—	—	16 6	15 3
	per cwt	per cwt.	per cwt.	per cwt	per cwt	per cwt.
Irish Creamery—Fresh	130 0	—	126 0	124 0	—	—
„ Factory	108 0	99 0	107 0	97 0	105 0	99 6
Danish	—	—	133 6	130 6	132 6	129 6
French	—	—	—	—	136 0	132 6
Russian	111 6	104 6	112 0	108 0	113 6	109 0
Australian	125 0	120 0	125 0	122 6	121 6	118 6
New Zealand ...	130 6	127 6	130 0	127 6	128 0	125 0
Argentine	123 0	120 0	125 0	123 0	119 6	117 6
CHEESE:—						
British—						
Cheddar	82 6	71 6	79 6	75 6	84 6	80 0
			120 lb.	120 lb	120 lb	120 lb
Cheshire	—	—	82 0	74 6	84 6	80 6
			per cwt.	per cwt.	per cwt	per cwt
Canadian . .	68 0	65 0	67 6	65 0	68 0	67 0
BACON:—						
Irish (Green) .	73 6	69 6	72 0	68 0	76 6	73 0
Canadian (Green sides)	69 6	68 0	68 6	65 6	70 6	67 6
HAMS:—						
Cumberland (Dried or Smoked)	—	—	—	—	138 6	123 6
Irish (Dried or Smoked)	—	—	—	—	127 6	118 6
American (Green) (long cut) .	73 0	68 0	68 6	63 6	-	72 6
EGGS:—	per 120.	per 120.	per 120	per 120	per 120.	per 120
British	—	—	—	—	18 11	18 4
Irish	17 11	—	17 1	14 8	16 0	14 0
Danish	—	—	15 5	14 5	17 0	15 0
POTATOES:—	per ton.	per ton	per ton	per ton	per ton	per ton.
British Queen . ..	75 0	65 0	—	—	71 0	60 0
Edward VII.	82 6	70 0	50 0	45 0	72 6	60 0
Up-to-Date	71 6	62 6	50 6	43 6	68 6	56 6
HAY:—						
Clover	—	—	90 0	70 0	85 6	79 0
Meadow	—	—	—	—	75 6	67 0

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	DECEMBER. 1913	DECEMBER. 1912	TWELVE MONTHS ENDED DECEMBER. 1913	TWELVE MONTHS ENDED DECEMBER. 1912.
Anthrax:—				
Outbreaks	66	42	594	743
Animals attacked	71	46	652	840
Foot-and-Mouth Disease:—				
Outbreaks	1	1	2	83
Animals attacked	50	6	73	645
Glanders (including Farcy):—				
Outbreaks	24	7	162	172
Animals attacked	116	11	447	315
Parasitic Mange:—				
Outbreaks	166	238	2 373	2,873
Animals attacked ...	287	514	4 624	6,068
Sheep-Scab:—				
Outbreaks	56	46	236	301
Swine Fever:—				
Outbreaks	239	192	2,573	2,920
Swine Slaughtered as diseased or exposed to infection .	2,513	2,341	32 034	39,653
Tuberculosis:—				
Number of Premises notified ..	511	—	*4,312	—
Number of bovine animals notified as for slaughter .	541	—	*4,686	—

Since 1st May, when the Tuberculosis Order came into operation.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE	DECEMBER. 1913	DECEMBER. 1912	TWELVE MONTHS ENDED DECEMBER 1913	TWELVE MONTHS ENDED DECEMBER 1912.
Anthrax:—				
Outbreaks	—	—	—	3
Animals attacked ...		—	—	3
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	68
Animals attacked ...	—	—	—	382
Glanders (including Farcy):—				
Outbreaks	—	—	1	—
Animals attacked .	—	—	1	—
Parasitic Mange:—				
Outbreaks	1	6	113	66
Sheep-Scab:—				
Outbreaks	78	36	552	373
Swine Fever:—				
Outbreaks	3	8	133	212
Swine Slaughtered as diseased or exposed to infection .	38	54	885	1,706

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THE POLLINATION AND FERTILISATION OF HOPS; AND THE CHARACTERISTICS OF "SEEDED" AND "SEEDLESS" HOPS.

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DURING the period of about 400 years in which the hop has been cultivated in England, the necessity of growing the male hop* in or near the hop-garden has at many different times been insisted upon by close observers, though it has also frequently been denied; most often, perhaps, the subject has been ignored by the practical grower. The following quotations from various sources show that the practice of growing male hops has been alternately recommended and discouraged

In *The Complete Farmer* (1769) we read that "Few hop grounds are without some plants of a sort of hop which many call the female hop, but very erroneously; for the female hop is that which is cultivated for use, and this, which others name more properly the wild hop, is the male. Towards the middle of July it puts out a great number of long loose bunches of small flowers, not at all like the true hop, and in somewhat less than a month after, that is to say, just before the true hop begins to blossom, they ripen, and with the least motion of the wind, shed a farina, which is wafted all around, and is by some, not improbably, thought to be of use to impregnate other hops. Those who are of this opinion advise, therefore, to leave one or

* The Hop (*Humulus Lupulus* Linn.) is *diœcious*, that is, the two sexes are borne on different individuals. The *female hop* bears the "hops" of commerce, the *male hop* produces only flowers with *stamens* containing *pollen*, and is usually called a "seeder" by the hop-grower. (The Yew is another instance of a *diœcious* plant.) In very rare cases individual hop plants (of no commercial or practical importance) occur which bear both male and female flowers (in distinct inflorescences), and such individuals are termed *monœcious*.

two hills of them standing in the hop-ground. But the common practice is to mark them at their first appearance, and to root them out afterwards because they do not bear bells or hops, and, as they are generally the strongest plants, sets might otherwise be taken from them by mistake."

Gilbert White, author of *Natural History of Selborne*, remarked (some time previous to 1793), with reference to hop-growing in Hampshire: "Hops are diœcious plants; hence, perhaps, it might be proper, though not practised, to leave purposely some male plants in every garden, that their farina might impregnate the blossoms."

In 1804, in Young's *Annals of Agriculture*, vol. 42, p. 289, we find this record: "Mr. Ruggles at Finchingfield [Essex] had some scattered male plants in his hop-ground; and remarked in 1800 that around these plants his crop was visibly better than in other parts of the field. It is common to leave the male plants near or in the hedges."

In 1807, in a book called *Practical Agriculture*, by R. W. Dickson, the male hop was condemned "In hops there are also male and female plants, but the latter only afford the produce for which they are cultivated, the former should of course be extirpated as improper and useless"

In 1831 and 1838 E. J. Lance published some important observations which, dealing with the subject in a scientific manner, gave the true botanical reasons for the cultivation of the male hop. In the *Golden Farmer* (1831) this keen observer wrote "We do strongly recommend all cultivators of the hop to have many male plants in their ground, and particularly to encourage them round their plantation in the hedges, where no ground will be lost; let there be some in all situations, so that, let whatever wind blow, the pollen may be wafted to the female." So convinced was this author of the practical value of the male hop that we can forgive his impatient outburst over the apathy of the hop-growers of that day; writing of male hops he says: "They grub them up wherever they find them as useless lumber, and say, 'Our fathers got money without them, and so can we; for why should we pretend to be wiser than our forefathers?'" In his later work, entitled *The Hop Farmer* (1838), the following interesting observations are given: "The impregnation [of the female 'burr'] may be observed in the direction of the wind from a male plant", and "those hops [which have been impregnated] are forwardest and will be ready for picking many days before those that have not received any of the male

farina." It is added, "a gentleman at Chevening, in Kent, cultivates a proportion of males in his grounds, and gets a fine pungent sample thereby." And again the author, exclaiming against the negligence of the practical cultivator, says: "The growers allow that the seed adds much to the weight, yet it is not sought after by the cultivators in general!!" It must be remembered, however, that at this period the subject wore an aspect somewhat different from that at the present time, since seed was more valuable, for the reasons that (1) it was recommended as practicable and advisable to renew one's stock from time to time by raising hop plants from seed; and (2) it was believed that some property valuable in brewing resided in the seed.

In 1848, S. Rutley, who was conversant with Lance's works, strongly recommended* the systematic cultivation of male hops, and mentioned a case where the planting up of male hops in a garden, in which previously there were none, had the effect, when the male hops grew to maturity, of making the hops which had before always been "small, loose and *hover*," grow out regularly, season after season, into large, firm hops. The author recommends that in planting up a new garden male hops should always be provided at the rate of "one male-planted hill to 100, or at most 150, hop-growing hills."

In the article on Hops in *Morton's Cyclopedia of Agriculture* (1875) we find similar advice being given. "In the planting of new grounds, attention should be paid to the introduction of a sufficient number of the *male plants*. One hill in 200, or about six on an acre, we consider to be ample. . . . The introduction of these male plants is a matter of extreme importance, and ought on no account to be neglected; for it is an established and indisputable fact that the grounds which possess them are more prolific, and bring the hops to maturity earlier, than those plantations which are deficient in them; and, in addition to these advantages, the hops are of a better quality."

It is clear, however, that all this sound advice as to the value of planting male hops was disregarded by the hop-grower generally. In the book entitled *Hops: from the Set to the Sky-lights*, published in 1881 by C. Whitehead (who grew hops in Kent), we read: "Many old-fashioned planters regularly cultivated a certain percentage of male plants among the female strobile [hop]-bearing plants, not so much, perhaps, to

* *Journal of the Royal Agricultural Society*, Vol. IX., "On the Best Mode of Managing Hops."

secure true seed reproductive of its kind, as to ensure fecundation, which they thought was necessary to the perfect development of the strobiles [hops] or flowers. . . . Modern hop-growers, however, finding that no practical good resulted from having one male to 200 or 300 female plants, have remorselessly grubbed the former, without any apparent loss of weight or quality, or diminution in the quantity of seed."

In Roland's *Farming for Pleasure and Profit* (1880), it is stated, with reference to the practice of hop-growers in the neighbourhood of Farnham: "The 'buck' or 'cock hop' is often unmercifully rooted up out of many hop-gardens as an useless cumberer of the ground."

About 1900, in Kent at any rate, the indiscriminate grubbing up of male hops became a common practice, except with a few observant growers. The reason for this was two-fold; in the first place, the male hops, not recognised as doing any good, occupied the place of a plant that could bear hops; in the second place, it appears that about this time—probably on the occasion of a heavy crop—a complaint was raised on the market that there was too much seed in English hops, and hop factors and others went about advising farmers to grub up all the male hops in their gardens.

Contrary to the statement quoted above, made by Whitehead, it was found in many cases that the eradication of male hops from gardens which had previously produced good crops was at once followed by disastrous results, the hops no longer "growing-out." It is to be noted that as Whitehead states that, following the grubbing of males from the gardens there was "no diminution in the quantity of seed" grown in the cases to which he refers, these gardens must still have been supplied with pollen carried into them on the wind from male hops growing in the neighbourhood,—a point of considerable practical importance which is considered more fully below.

A scientific study of the details of the subject has demonstrated that the old practice of growing male hops is undoubtedly right, and that no worse advice could be given to the English hop-grower than to grub up all male hops.

This scientific information was first sent out in 1904 from Wye College, in a Leaflet containing *Observations on the "Growing-out" of the Hop*, by Mr. A. Howard, and in a more extended form in 1908, in a Leaflet, entitled, *On the Value of the Male Hop*, by Mr. Arthur Amos and the writer. Since then accounts of further investigations into the subject have been published in the writer's *Notes on Hops*, published in 1909 and 1910 (*Jour. S.E. Agric. Coll.*, Vols. XVIII. and XIX.).

Owing to this information sent out by Wye College, and the attention which has been thereby directed during the past 10 years to the practical value of the male hop, it can now be said that in many hop-growing districts not only is the practice of grubbing up male hops being discontinued, but that the necessity for the systematic planting up of the right kind of male hop is yearly being recognised more and more fully, with the result that "cuts" or "sets" from such males are eagerly sought after.

The scientific and botanical aspect of the subject, as well as the practical considerations involved, will now be fully dealt with.

The Botanical Structure of the Hop.

In order to be able to give in the necessary detail the evidence which establishes the value of the male hop, it is essential to consider first the botanical structure of a ripe hop. Hops, such as are shown in Fig. 1, are made up of what growers call the "petals" or "scales,"—which shatter as the hop becomes over-ripe,—the stalk or "strig," on which the "petals" are borne, and usually a number of "seeds" attached to the "strig" close to where the "petals" are borne. Considered botanically, the "petals" or "scales" of which every hop is composed fall into two classes, some being called ***stipular bracts***, and others, ***bracteoles***. These can be distinguished by their different shape; the ***stipular bracts*** (Fig. 1, A) are more rounded at the ends, which are suddenly pointed; the ***bracteoles*** (Fig. 1, B) are longer, narrower at the tip, and of a brighter yellow colour than the stipular bracts when the hop is ripe Two stipular bracts are shown in Fig. 2 in the top row, below are two bracteoles, partly enfolding two ***seeds***, and between them a detached seed; in the bottom row are two bracteoles,—noticeably smaller,—which are without seeds. In Fig. 3 are shown two hops partly dissected to show the position of the stipular bract and the bracteoles on the "strig." As regards the relative number of stipular bracts and bracteoles in each hop, it is the invariable rule that there is a pair of bracteoles present for each stipular bract. A hop of thirty "petals" will, therefore, always be composed of ten stipular bracts and twenty bracteoles.

We may now consider the possible reasons why gardens where the hops have shown plenty of "bine" and plenty of "burr" may yield a poor crop through the hops not having "grown out." In the first place it is obvious that the number

of stipular bracts and bracteoles, *i.e.*, of " petals," must account *to a certain extent* for the length of a hop. There must be something with which to build up the hop, and it is obvious that if there is not enough material to start with in the shape of stipular bracts and bracteoles the hop must remain small. It is also obvious that if the number of " petals " were the *only cause* which determined the length of the hop, we should find the hop increasing in length *only as the number of " petals " increased.* Such is the case, we actually find, with seedless hops. Foreign seedless hops, such as are found in certain samples of German and Belgian hops, if measured and then picked to pieces and the number of " petals " counted, show that the length of the hop increases in proportion as the number of *bracteoles** increases. Such a case is given in Table I.

TABLE I.

Variety	Length of hop Inches.	No. of seeded bracteoles	No of seedless bracteoles.
Belgian Hops ..	$\frac{3}{4}$	0	22
	1	0	30
	1	0	34
	$1\frac{1}{4}$	0	40
	$1\frac{1}{4}$	0	46
	$1\frac{1}{4}$	0	46
	$1\frac{1}{2}$	0	52
	$1\frac{1}{2}$	0	64
	$1\frac{1}{2}$	0	66
	$2\frac{1}{4}$	0	102

If the production of a sufficient number of " petals " were the only cause on which the " growing out " of hops depended, then the question would resolve itself into one of the proper cultivation and manuring of the hop garden in order to induce a sufficiently vigorous growth of the hop-plant. Investigations have shown that in comparatively very rare cases hops do not " grow out " properly because the number of " petals " produced is not sufficient to build up a large hop. This is sometimes due to the hop-plants having become weakened through adverse weather conditions, through the wrong variety of hop being planted for the particular soil, or through some fault of cultivation or manuring. *In the great majority of cases,*

* For every two *bracteoles* there will be present one *stipular bract,* and their combined number gives, of course, the number of " petals " in the hop.

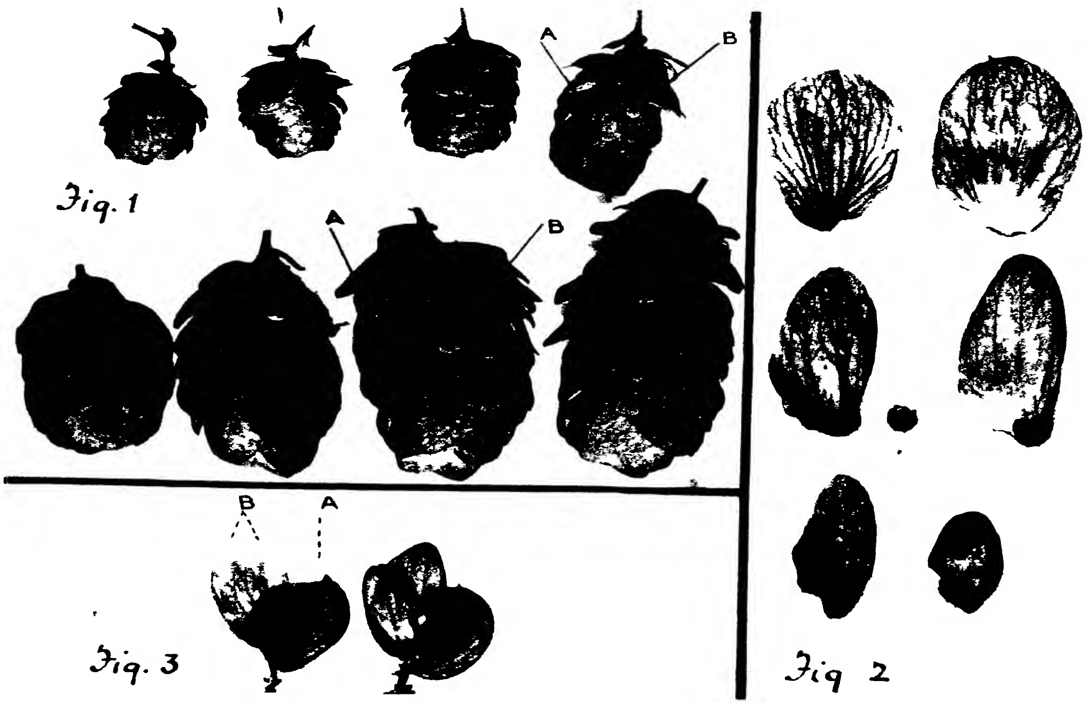


FIG 1 —Seedless and Seeded Golding hops (Canterbury Whitebines) The seeded hops are in the lower row A Stipular bract B Bracteole

FIG 2 —Top row Two *stipular bracts* Middle row Two *seeded bracteoles*, and a detached *seed* Bottom row Two *seedless bracteoles*

FIG 3 —Two hops partly dissected to show the position of the *stipular bract* (A), and *bracteoles* (B) on the strig back and front views

however, it will be found that a sufficient number of petals *is* present for a large hop to be produced, but that the hops do not "grow out" *owing to the lack of fertilisation of the "burr" and the consequent lack of seed in the hop.*

The Use of the Male Hop.

Investigations have shown that it is only when a certain amount of seed is present that the hops (of most varieties cultivated) "grow out" properly. It is therefore most important to know how seeds are produced. The part of the hop called the "burr" by the grower is, botanically, an *inflorescence* or collection of female flowers, and the "brush" consists of the feathery *stigmas* of these numerous female flowers. In order that the ripe hop may contain seeds, it is absolutely necessary for the "burr," or collection of female flowers, to be pollinated and fertilised by grains of pollen blown from a male hop plant to the "brush."

As most hop-growers have noticed, when a male hop, or "seeder," is in bloom, and its branches are tapped or gently shaken, it will throw out (especially in hot weather) a large amount of a whitish dust-like substance; each particle of this dust is called, botanically, a pollen-grain—(the word pollen is here used in its true botanical sense, the same word is commonly used by growers to describe the yellow lupulin glands, or "condition," on the "petals" of the ripe hop,—the two things being, of course, quite different). When pollen-grains from a male hop are carried by the wind to the "burr," they fertilise the female flowers, *with the result that a certain number of the bracteoles of the ripe hop produce seeds at their base.* Reverting to Fig. 1, we can state now the essential difference between the *stipular bract* and the *bracteole*; it is this: the stipular bract is always "sterile," *i.e.*, there is never a seed at its base, and it is unchangeable in size, but each bracteole is capable (but only if a female flower has been fertilised) of bearing a seed at its base,* *in which case both the bracteole and the adjacent part of the strig grow larger, and thus cause the hop to "grow out."*

The following simple experiment shows that if no pollen-dust from a male hop reaches the "burr," no seeds are produced and the hops do not "grow out." Two fertile side-branches growing from the same stem ("bine") of a hop-plant are enclosed separately in paper-bags, at a time just

* Actually, of course, the seed is borne on the "strig," and the base of the bracteole only enfolds it.

before the "burr" appears. When the "burr" has fully developed, the bag is removed from one branch and pollen-dust from a male hop is brushed on to the "burr" with a paint-brush, the bag being then replaced. The bag is not removed from the other branch during the "burr" stage. When the "burr" has disappeared from both branches, the bags are removed and the young hops allowed to develop in the open air. It will invariably be found that only the hops borne on the branch of which the "burr" was fertilised by pollen-dust contain seeds and are "grown out"; the unfertilised branch only bears small seedless hops which are not "grown out." The photographs in Figs. 4 and 5 show the relative size of seeded and seedless hops (Canterbury Whitebine) produced by opposite branches of the same bine under identical conditions, except that in the case of the hops in Fig. 4 the "burr" was supplied with pollen-dust

The Effects of Fertilisation in relation to Hop-Mould and Blight.

A point of considerable practical importance may next be considered, viz., the connection between fertilisation and hop "mould" and "blight."* If experiments or careful observations are made it can be seen that the *first effects of fertilisation* are as follows. Soon after the pollen-dust has reached the "burr," the "brush" (*stigmas*) turns brown, dies off and falls away, and the "burr" at once grows out, or "falls," into hop. If, however, no pollen-dust reaches the "burr," *the hops remain in "burr" for some time,* on the chance, as it were, of some pollen-dust coming along. The photographs shown in Figs. 6 and 7 well illustrate this fact. In one experiment two opposite branches on the same bine were enclosed in bags a few days before the appearance of the "burr" On July 27 the two branches were in "burr"; the bag was then removed from one branch only, and pollen-dust was brushed over its "burr." The bag was then replaced. On August 21st both bags were removed; the branch that had been pollinated had already grown out into fair-sized hops (see Fig. 6); the branch whose "burr" had not received pollen was so backward that some "burr" still remained (see Fig. 7, to right), and the hops elsewhere on this branch were much less developed than those on the pollinated branch. In every case investigated it was the same; if no pollen-dust reached the "burr,"

* Hop "mould" or "mildew" is caused by the fungus *Sphaerotheca humuli*, and "blight" is caused by the insect *Phorodon humuli*.

FIG 4 FIG 5

FIG 4 —A branch of seeded Golding hops, produced on the same bine and under identical conditions as in Fig 5, except that here the "burr" was fertilised with pollen

FIG 5 —A branch of seedless Golding hops

the branch remained in "burr" a much longer time, instead of at once growing out into hop.

Now the time when hops are in "burr" represents, as every hop-grower knows, a very critical period. "Mould" or "blight" may get into the "burr," and the whole crop be lost.

The fact that fertilisation very appreciably hastens the "growing out" of hops, or in other words shortens the critical period when hops are in "burr," demonstrates the value of the male hop in one direction.

Further, the effect of fertilisation in tending to prevent "mould" is not limited to the "burr" period, but can often be observed at later stages when the hops are more developed. Observations show that seedless hops are more liable to "mould" than seeded hops, and also that if, as often happens, a hop is seeded in one portion and seedless in another portion, "mould" is far worse in the seedless part, while (in the same hop) the larger bracteoles of the seeded part remain practically free from "mould." The explanation of this fact is probably that the seedless bracteoles, remaining as they do small and green, are specially susceptible to the attacks of the mould fungus, while the seeded bracteoles are stimulated to grow larger through the effects of fertilisation, and soon ripen off, taking a brighter yellow colour. It is an interesting botanical fact, and one not without practical importance, that if only one of a pair of female flowers is fertilised, with the result that only one seed is produced, both bracteoles are stimulated to grow larger. The fact that seeded hops ripen earlier than seedless hops is one of considerable practical importance, especially in unfavourable seasons.

The Value of the Male Hop from the Practical Standpoint.

Returning now to the subject of the practical effect of pollination as regards the crop of a hop garden, it can easily be observed in gardens *that well grown out hops always contain a good proportion of seed.* This rule holds good at any rate for all Golding varieties of hops; in some cases, as shown later, the Fuggles hop may form an exception. The leaflet by Mr. A. Howard, published from Wye College in 1904, contains the following statement: "No well grown out hops were seen without seeds." In going over the same grounds the writer has been convinced of the soundness of Mr. Howard's observations. Besides making observations in hop gardens which have led to the same conclusions as Mr. Howard's, the writer, with the assist-

ance of Mr. Arthur Amos, employed a fresh method in order to obtain more detailed and statistical evidence on the subject of the influence of the male hop. Samples of 25 to 100 ripe hops were obtained from gardens in different parts of Kent and Surrey. An analysis was made of *every hop*; *i.e.*, each was first measured, and then picked to pieces, and the number of *bracteoles* with a seed ("seeded bracteoles") and those without a seed ("seedless bracteoles") were recorded. Analyses of one lot of samples are reproduced in Table II.

TABLE II

Locality and Remarks.	Length of hop in inches	Seeded bracteoles	Seedless bracteoles.	Total No. of bracteoles. *
Wye College hop garden, 1907. Part of garden where the hops "grew out."	1	5	19	24
	1	8	16	24
	1	5	21	26
	1	6	18	24
	1¼	12	22	34
	1	7	19	26
	1	7	23	30
	¾	4	10	14
	1	9	21	30
	1	7	17	24
	1¼	6	28	34
	1¼	10	22	32
	1¼	10	32	42
	1	8	20	28
	1	8	22	30
	1	8	16	24
	¾	4	10	14
	1	9	21	30
	1	7	23	30
	1	8	18	26
	1	7	19	26
	¾	3	15	18
	1¼	12	18	30
	1½	16	18	34
	1½	14	22	36

In such a table as this one can see more or less clearly that the number of seeds influences the length of the hop. But it must be remembered that another cause is at work, for

* The number of *stipular bracts* is not given, since these are invariably "sterile," and occur always in the proportion of one *stipular bract* to every two *bracteoles*. Thus in the first hop there were 24 *bracteoles* and 12 *stipular bracts*, or 36 "petals" or "scales" in all.

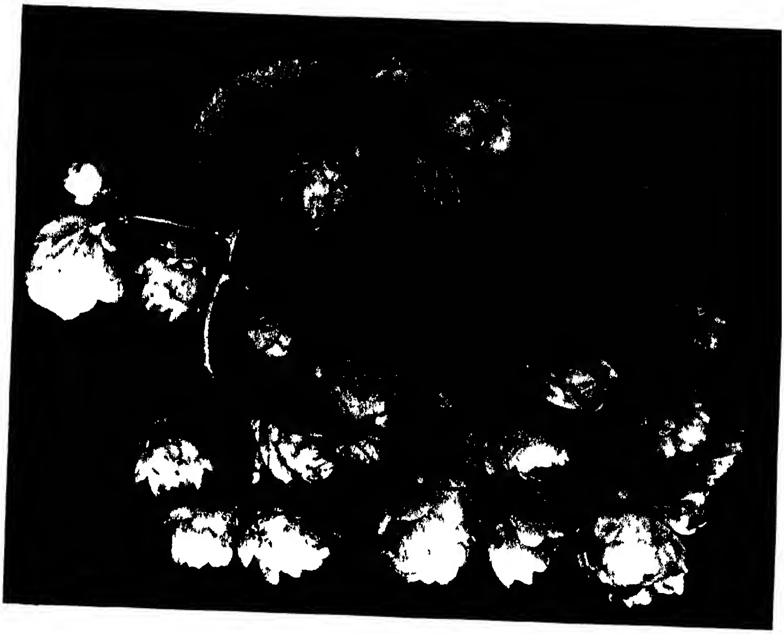


FIG. 6

FIG. 7

Two opposite branches of hops growing on the same bine; their appearance on August 21. On July 27 both branches were in "burr." In the branch shown in Fig. 6 the "burr" was then dusted over with pollen, while no pollen was put on the "burr" of the branch shown in Fig. 7.

the length of a hop will increase according as the number of its *stipular bracts* and *bracteoles* increases, even if the latter are all seedless. But in these tables evidence is usually found that hops containing the same number of bracteoles increase in length according as the number of seeds increases. If one scans the last column of Table II. and notes those hops which have 30 bracteoles, it will be seen that it is only when the number of seeds is over ten that the length of the hop exceeds an inch.

There are, then, two different causes at work influencing the length of the hop. To present the evidence in the clearest way, *only those hops which are composed of the same number of bracteoles must be compared.* Then there will be only one cause at work influencing the length of the hop, viz., the number of seeds In the series of diagrams shown in Tables III. to IX. the hops concerned all belong to the Golding type, in which are included the Canterbury Whitebine, Bramling, Early Bird, Farnham Whitebine, and Mathon. The hops were obtained from gardens in the following districts :—Faversham, Sittingbourne, Maidstone, Ashford, Wye, Petham, and Wingham, in Kent ; Farnham and Puttenham, in Surrey ; and Bodiam, in Sussex. The samples of hops were collected by the grower, who was asked to pick one sample from a garden where the hops were well grown out, and another from a garden where the hops had not grown out well.

The evidence collected from the analyses of these hops is presented graphically in Tables III. to IX., in the following manner.

TABLE III.

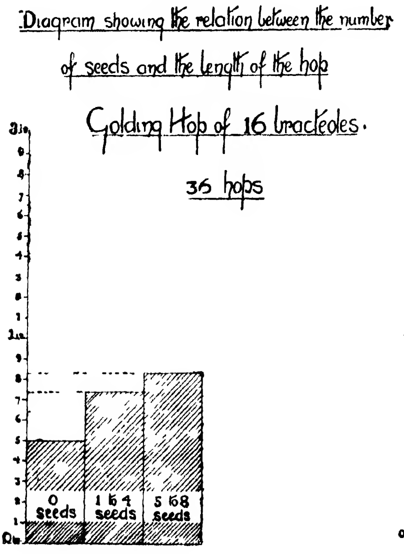
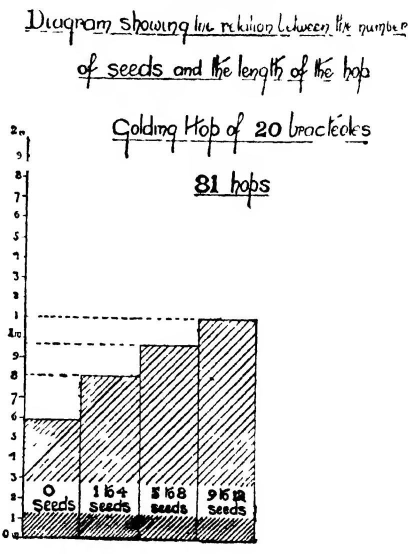


TABLE IV.



In Table III. each of the three shaded columns represents the average length of Golding hops containing respectively no seeds, one to four seeds, or five to eight seeds, *all these hops being composed of sixteen bracteoles.* The upright scale on the left is divided into tenths of an inch, and shows that hops containing no seeds attain on the average a length of $\frac{5}{10}$ inch; hops containing 5 to 8 seeds attain on the average a length of between $\frac{8}{10}$ and $\frac{9}{10}$ inch; while hops with only 1 to 4 seeds are intermediate in length. This shows that in hops having exactly the same structure, *i e.*, composed of 16 bracteoles, the average length of the hop containing 5 to 8 seeds is nearly double that of the seedless hop.

Take now the case of hops composed of 20 bracteoles, of which 81 were found in the samples sent. Table IV. shows that the average length of the seedless hop is $\frac{6}{10}$ inch, and that the length of the hop increases according as the number of seeds increases, the average length of the hops containing 1 to 4 seeds being just over $\frac{8}{10}$ inch, of those containing 5 to 8 seeds between $\frac{9}{10}$ and 1 inch, while the average length of hops containing 9 to 12 seeds is $1\frac{1}{10}$ inch, or nearly double the length of the seedless hop.

TABLE V

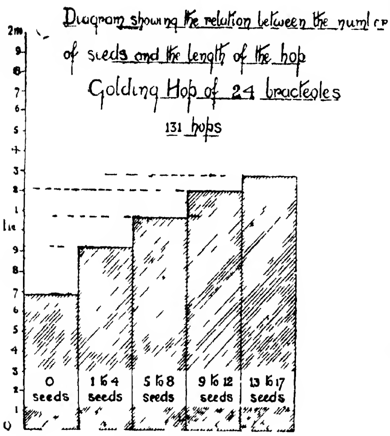
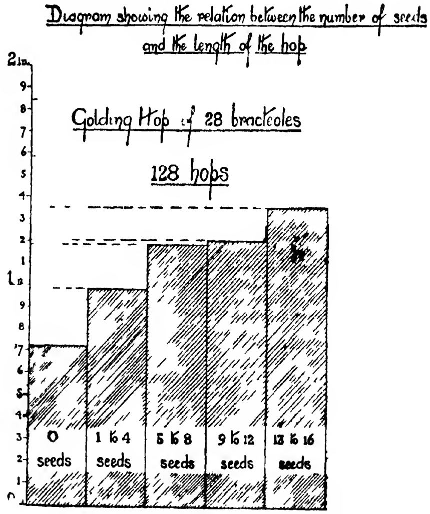


TABLE VI.

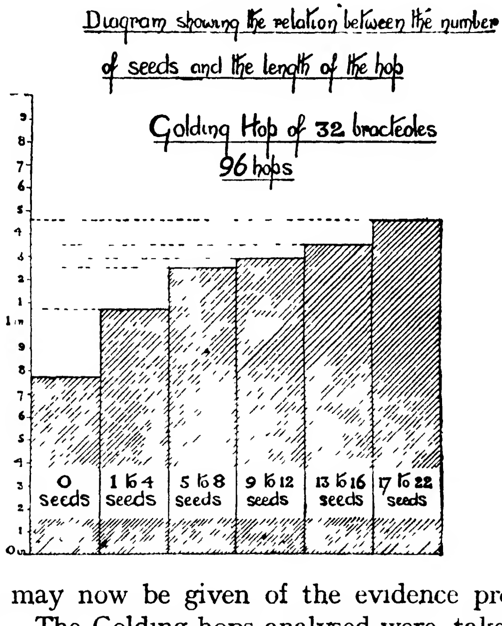


In Table V. are shown the results of the analyses of 131 Golding hops, each composed of 24 bracteoles. Here, again, it is clear that the average length of "seeded" hops containing 13 to 17 seeds is nearly double that of the seedless hop. Table VI. shows the results of the analyses of 128 Golding hops each composed of 28 bracteoles, and the evidence proves to be the same.

The analyses of Golding hops composed respectively of 32 and 36 bracteoles are shown in Tables VII. and VIII., and in each case the hops containing a fair proportion of seeds are nearly double the length of the seedless hops.

In Table IX. are given the results of the analyses of 52 Golding hops, each of which is composed of from 41 to 50 bracteoles—an unusually high number for a Golding hop. The amount of seed still determines the length of the hop—the seedless hop of from 41 to 50 bracteoles is, on the average, only 1 inch in length; if, however, 17 to 24 seeds are present the length of the hop is increased by $\frac{8}{10}$ inch.

TABLE VII.



A review may now be given of the evidence presented in these tables. The Golding hops analysed were taken without any selection from samples collected in gardens scattered over Kent, Surrey and Sussex. As the most representative series, those hops which were composed of 16, 20, 24, 28, 32, or 36 bracteoles were chosen, and these were arranged, each in its own class, according to the number of seeds each hop possessed. The average length of the hop in each class was then determined, and the diagrams shown in Tables III. to VIII. were prepared. It was found, as the diagrams clearly show, that *in every class the length of the hop increases regularly and in more or less strict proportion as the number of seeds increases, so that the well-seeded hop is invariably nearly double the length of the seedless hop.* In

other words, the length of a hop, no matter whether there are few or many "petals," may be nearly doubled by the production of plenty of seed. If 1 inch is taken as the length which may be considered sufficient to class a hop as "grown out," then this is reached by the seedless hop only in the altogether exceptional class where the hop is composed of from 41 to 50 bracteoles. The average number of bracteoles per hop in the Golding varieties appears to be 28 to 30 according to the season,

TABLE VIII.

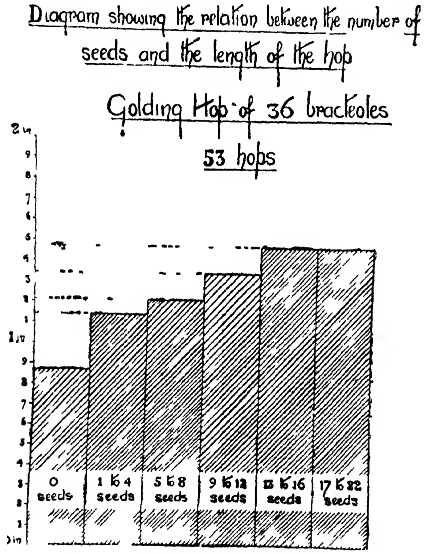
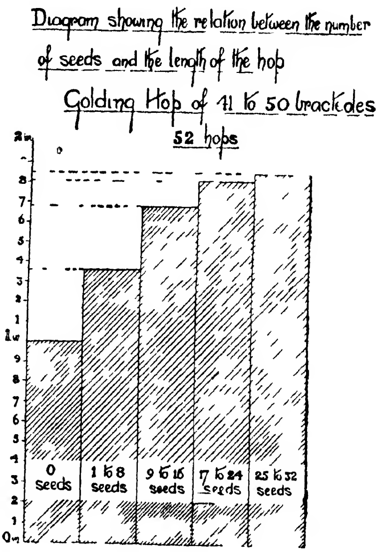


TABLE IX.



and therefore (Tables VI and VII.) the average seedless hop would be only between $\frac{7}{10}$ and $\frac{8}{10}$ inch long

It must be remembered that a slight increase in the average length of the hop, involving also an increase in its breadth, means a considerable increase in the weight of the crop per acre. In a certain case, to be described later, in a Golding garden, an increase of $\frac{1}{4}$ inch in the average length of the hop was found to be equivalent to an increase of 4 cwt. per acre in the crop.

Such evidence as that detailed above, which has been obtained from the analysis of over 2,000 hops, shows conclusively that *Golding hops grow out properly only when seeded, and thus demonstrates clearly the great value of the male hop.*

(*Continued.*)

ROTATION OF CROPS.

BY the term "rotation" as applied to agriculture is understood the growing of different crops in a more or less regular alternation over the cultivated portion of a farm.

In the earliest times wheat was grown continuously on the same land until the resulting exhaustion necessitated the abandonment of further cropping. Left to itself the land would in course of time accumulate a fresh stock of fertility and wheat growing would again be pursued. It is interesting to note that this primitive practice, and a simplified modification of wheat and bare fallow in alternate years, still prevails on the virgin soils of thinly-populated countries. The earliest rotation in this country which can claim to be definitely systematic was that said to have been introduced by the Romans, viz.: a three-course succession of wheat, beans, and bare fallow. This rotation appears to have been very generally followed in Britain till about the beginning of the eighteenth century, when the introduction into British agriculture of other crops, notably clover and turnips, gave rise to a rotation thereafter to be widely known as the Norfolk four-course rotation, which took its name from the county where it was first practised This rotation forms the basis of all the British systems of arable farming in vogue at the present day, with the exception of those practised on the heaviest soils, where the more common root crops cannot be successfully grown.

Reasons for Rotations.

The main reason for growing a series of crops is, briefly, an economic one. It is well known that crops differ both in their food requirements and in their capacity to extract and utilise the various materials that make plant food. Leguminous crops, such as clover and beans, are largely independent of soil nitrogen, being capable of utilising the nitrogen of the air. Turnips depend largely on a ready supply of phosphates. Again, some crops (*e.g.* barley) are shallow-rooted, and are consequently dependent on an available supply of food near the surface. Others, again (*e.g.* all tap-rooted plants), send their roots deep into the soil and draw their food supply from a comparatively extended area. Furthermore, some (*e.g.* wheat) occupy the ground for a longer period than others, and consequently have more time in which to enlarge their root system and reach the reserves of plant food in the soil. The potato

crop, on the other hand, is comparatively short-lived ; it is, moreover, a shallow but gross feeder, thus necessitating an ample store of food material near the surface. It will be readily understood, therefore, that a suitable alternation of crops is necessary to the economic utilisation of the resources of the soil.

It is, of course, an established fact that on rich, virgin soils wheat alone may be grown successfully for years, but a time ultimately comes when the requisite food supplies in the soil are not sufficient to produce a profitable crop. Recourse must then be had to extraneous supplies of plant food. Even in this country wheat may be grown practically continuously on the same soil, provided it is adequately manured. Mangolds and potatoes, also, are often grown year after year on the same plots of specially treated land, and it may be fairly assumed that, in the special circumstances of the case, such practice is not only justifiable and expedient, but highly profitable as well.

Permanent pastures constitute another example of non-rotational cropping, but the continuity in this case is more apparent than real, since the herbage of a pasture is constantly undergoing a change in its flora.

In the case of some crops frequent repetition leads to lowered vitality and the development of fungoid diseases and other pests, a conspicuous example of this being "finger-and-toe" in the members of the turnip family. But the incidence of disease is, after all, only a secondary consideration, for diseases will usually yield to treatment other than that involved by establishing a suitable rotation. The aim should be to get as full a return as possible from the land without producing undue exhaustion.

In the best rotations one crop follows another in quick succession ; for example, in suitable localities, rye-grass or another fodder crop immediately takes the place of early potatoes, and wheat is sown as soon as the main crop is removed. So, again, barley follows immediately after the last turnips have been consumed, and oats after the grass has been turned down. A further advantage, not to be overlooked, which a suitable rotation provides, is the constant and almost uniform employment of labour throughout the year, the disadvantage of casual labour thus being largely obviated.

All things considered, experience proves that some method of alternating crops on arable land will generally lead to the largest and most profitable returns.

Considerations which determine a Rotation

In determining the order of cropping suitable for any particular district several important considerations have to be borne in mind. Chief among these is probably the climate: altitude and exposure, average temperature and rainfall are all determining factors. The successful cultivation of such crops as mangolds and wheat is chiefly confined to the warmer and drier parts of Great Britain along the southern and eastern coasts. Potatoes, oats and turnips, on the other hand, reach perfection in the cooler and moister climates of the north and west. Sainfoin and maize, as forage crops, are restricted mainly to the warmest counties.

In conjunction with climate, the character of the soil must be considered. Loamy soils are the most widely adaptable of all, being capable of growing successfully practically all kinds of crops. On stiff clays, only such crops as wheat, beans, mangolds and cabbages grow to advantage, while on the lighter soils, barley, peas, early potatoes and carrots are found to answer best. Chalk soils are particularly suited to leguminous crops, clovers, lucerne, sainfoin and the like, and peaty soils will grow large crops of potatoes, oats and rye-grass.

Apart, however, from the limitations imposed by soil and climate, the most important governing factors in determining the method of farming should be transport facilities and the demand of the market. The requirements of live stock must also be considered in determining the kinds and order of the crops to be grown Suitable foods must be provided for them throughout the year, and the bulk of these may be most economically grown on the farm. Feeding cattle, dairy stock and sheep all require separate consideration and will variously affect the kinds and order of the crops on the farm.

Attention to the foregoing principles may be regarded as of the essence of commercial agriculture, but in practice other factors are found at work in fixing the method of farming. The supply of labour must be taken into account, as also the capital at the farmer's disposal.

Further, it is usually found that the particular practice adopted is largely regulated by the style of farming to which the cultivator has been accustomed. In any particular district the order and kind of cropping has been arrived at through years of experience, and a new-comer will usually be well advised to regard carefully the methods and results of his neighbours before making any serious departure from local traditions. At the same time, it by no means always follows that recognised custom is the best and most profitable practice.

One has but to remember the well-known example of Essex, where the introduction of dairy farming, and the consequent laying down of much of the heavier land to grass has, within the past twenty or thirty years, revolutionised the old-time arable cultivation of which wheat was the staple product. The proximity to London, and the ever-increasing demand for milk, have been instrumental in restoring to cultivation much of the land left derelict in the eighties, when the competition of the cheap lands overseas first began to be seriously felt. Instances are numerous in which the introduction of new crops and methods of farming have very largely increased the value and output of the land. For example, certain crops usually grown by the market gardener (*e.g.* broccoli and Brussels sprouts), are now being extensively cultivated by the ordinary farmer favourably situated as regards market and means of transport. In a time of over-production he has the advantage over the market gardener of being able to feed such crops to his live stock. The market-gardening at Evesham, on what was, but a few years ago, poorish grass land ; the strawberry-growing on some of the poor sands of Hampshire ; the fruit-growing and potato-growing of Wisbech and the Fens ; and the intensive culture of the light heath-lands of Biggleswade and neighbourhood, are all cases of the successful introduction of new methods of cropping.

A few instances of rotations practised in different parts of the country may now be given. In view of the necessarily diversified character of British agriculture it would be impracticable to attempt accurately to classify rotations in accordance with particular circumstances and conditions, but in the following pages a rough classification is given, with soils as a primary determining factor, while a few explanatory notes are added to show the adaptation to local peculiarities of the rotations referred to.

Light or Medium Soils.

Norfolk Rotation.—Taking first the most notable, historically, viz., the Norfolk four-course rotation, the general order of cropping is found to be as follows :—

1st year, Turnips ; 2nd year, Barley ; 3rd year, Clover ; 4th year, Wheat.

Over great stretches of Britain to-day this rotation, with slight variations as found expedient, is very generally practised. The soils best suited to its use are loamy in character. In those localities where the production of malting barley is a speciality one finds this crop occurring twice in the rotation, viz., after turnips and again after wheat, it being generally

believed that the finest malting sample is grown as a second white or straw crop. This is probably due to the fact that a more even balance of fertilising material, a finer and more uniform tilth, and consequently more equal ripening, are obtainable after wheat than after roots, where the latter are, frequently, in part at least, fed off with sheep.

In the cooler, moister districts oats succeed roots, and oats are also sometimes taken as a fifth crop, after wheat.

The large area devoted to roots pre-supposes stock-feeding and, as a rule, both bullocks and sheep are extensively fattened in those areas where the larger and arable portion of the farm is devoted to this rotation. The main feature of such farming, however, consists in the sale of crops. The frequent occurrence of turnips and clover conduces to "finger-and-toe" and "sickness," respectively, and repeated applications of lime are necessary. Occasionally sainfoin takes the place of clover, but too frequently the sowing of clover, exclusively, is persisted in, the result being a patchy herbage with weeds often predominating. It would be far better in such circumstances to include some rye-grass in the clover mixture.

On arable farms where considerable attention is paid to stock-rearing, the "seeds" are left down an extra year, and this practice is also followed on the poorer corn-growing lands as a means of restoring potential fertilising material in the form of grass turf, decayed vegetable matter or humus being a valuable source of nitrogen. This is the principle underlying the Clifton Park system of farming, where a grass mixture of deep-rooting plants is left down for four or more years. It is a system especially adapted to thin soils in outlying parts of the farm, cartage of manure to which is either impossible or too costly.

The widening of the interval between recurring crops of clover and turnips is a potent factor in minimising risk of disease.

East Lothian.—The subject of rotations on the lighter classes of soils would be incomplete without reference to the famed farming of East Lothian, where, on lightish soils, not naturally rich, some of the finest agriculture in the world is to be seen. A typical East Lothian rotation is the following:—

1. Turnips (swedes); 2. Barley; 3. "Seeds" (rye-grass and clover-hay); 4. Oats; 5. Potatoes or beans; 6. Wheat. This arrangement provides for at least two cleaning crops (turnips and potatoes); three different cereal crops with a crop of another type between each; and nitrogen-collecting crops. The most noteworthy feature of this class of farming

is the number of crops that are sold off the farm. It is to these that the farmer looks for his main profit. Little stock rearing is done. The turnips are consumed partly on the land by sheep and partly by bullocks in the yards. The mainstay of the rotation is probably the potato crop, and this receives the bulk of the manures applied. It is peculiarly fitting, therefore, that wheat should follow immediately after the potatoes are removed, thus obviating risk of loss, by leaching, of the considerable manurial residue usually present. It is the custom to top-dress the "seeds" with nitrate of soda and encourage a grassy rather than a clovery herbage, with the result that the succeeding oat crop, being similar in its food requirements to rye-grass, is prone to suffer from the disabilities usually concurrent with successive gramineous cropping. The taking of repeated or even frequently interpolated grain crops is a very exhaustive method of farming and soon has a deleterious effect on the lighter classes of soils.

Denmark.—In this connection it may be interesting to record the experience of Denmark. Although formerly a grain-producing country, the substitution of dairying has modified the entire practice of farming and resulted in a prosperous and thriving agricultural community. Much of the soil is poor, but it would be difficult to conceive a system more suited to such soil than that now practised As many cows as possible are kept, and large quantities of feeding stuffs are bought. The manure produced is carefully husbanded and applied in small dressings frequently during the rotation. The fullest use of the manure is thus made and the land benefits not only from the accession of the greatest possible amount of fertilising material but is also improved in "body" and in the capacity for holding moisture which is so essential on such light, dry soil. It is only rarely that any artificials at all are applied in the course of the rotation.

A seven-course rotation of crops is the one in general use in Denmark, viz:—

1. Rye; 2. Roots; 3. Barley or oats; 4. Clover and grass; 5. Clover and grass; 6 Oats; 7. Fallow or forage crops.

The rye is sown in autumn, and that portion of the land which has, earlier in the year, borne non-leguminous forage crops receives a moderate dressing of dung. The rye is cut in May and fed green to cattle. Dung is ploughed under in autumn or winter in preparation for the root crop, and, in addition, artificials are sometimes given at seed-time. Most of the root area is devoted to beet, but mangolds, turnips,

potatoes and carrots are also grown. The prominence of beet is due to the desire to grow a root crop that will not taint the milk, and also to the fact that, on account of its deeper-rooting habit of growth, the beet is better suited to light land than the turnip.

Sometimes another crop of cereals is taken before the roots, thus utilising the ground immediately after the rye is removed in spring.

Along with the barley is sown a "seeds" mixture composed of deep-rooting, tall-growing grasses and clovers. Part of the herbage is mown and part grazed in both years, and liquid manure is applied both in spring and autumn. The fertility inherent in a good turf is thereby secured for the next crop (oats), which is usually followed by forage crops, such as peas, six-rowed barley, and mixtures of cereals and leguminous crops, which are partly fed green and partly made into hay. Only specially foul parts are left fallow.

Great Britain compared with Denmark.—In contrast to the English farmer, who in the depression which set in about 1875 proceeded to lay down much of his land to grass, the Dane went to the other extreme and ploughed up every available acre—not to grow corn but to produce butter. The Englishman sought relief in the curtailment of his labour bill, the Dane increased his expenditure in that direction. The conditions of the two countries, however, are totally different. Denmark with its light soil is unsuited to pasture The holdings are small, they are all of the same nature, and the occupants and their families do most of the work, supplying that personal attention to detail which, in conjunction with co-operation, enables the small holder to make a comfortable and sometimes highly profitable living.

The restriction of the corn-growing area in this country gave place to increased interest in live stock. Our superior flocks and herds have up to the present enabled us to compete with fair success with the beef and mutton producer of the prairies and the grazing lands of the newer countries.

Dairying, especially milk-selling, was adopted in conjunction with arable cultivation, and in suitable districts it has proved highly remunerative.

The laying down of much of the heavier land to grass has enabled the farmer to devote greater attention to, and increase the production of, the arable portion that remained. Whilst able to grow the greater proportion of the food of his cows on the farm, the exigencies of the case demand also the purchase of feeding stuffs. The output of manure is thereby

both augmented and enriched, and the physical condition as well as the fertility of the land is improved. This joint arrangement of arable and grass farming is, in effect, the Danish system applied to British conditions. At the same time the chances are that much of the lighter land of England now in grass would give a better return, whether in milk or in crops, if restored to cultivation.

Ayrshire.—On the warm, sheltered, light soils of that part of Ayrshire devoted to continuous early potato growing, catch crops are sown immediately the potatoes are removed. Rape is most generally chosen, and is consumed on the land by sheep in the early autumn. Italian rye-grass for sheep-feed is also sown, and trials have recently been made of an early maturing variety of Italian rye-grass known as Western Wolths grass, the chief characteristic feature of which is its capacity for attaining a bulky and mature growth in the course of a few months. Early-ripening barley of the four- and six-rowed types is also sown, and mainly fed green, the surplus, in a favourable year, producing a good yield of more or less ripened seed. Few farms are devoted entirely to early potato growing, only that portion of them which consists of the special red sandy soil being so cropped. On this soil a five- or six-course rotation is practised, including wheat and oats, roots and temporary leys

Heavy Soils.

Many of the heavier clay soils are in grass. Particularly is this the case in districts near a railway station, where dairying can usually be undertaken with profit.

A portion of such land is generally cultivated to provide the necessary winter provender in the shape of straw and roots, and where pastures are apt to fail in late summer the cultivation of vetches, maize or lucerne to supplement the diminishing supply of grass is widely practised. Where permanent grass predominates, the holdings are usually of considerable extent owing to the difficulty frequently experienced of making a fair living from dairying alone on a small grass holding

Essex.—In the less accessible areas a rotation of wheat, beans and bare fallow, or wheat, beans, barley and bare fallow, has long been and is still practised on some of the heaviest cultivated clays. It is found, for instance, in one particular portion of Essex on the London clay, where most of the land is cultivated, and where no roots are grown, few stock are kept, and the only manures used are artificials. An improvement on this rotation is effected where practicable by the introduction of a clover crop, and of a root crop suited to heavy

land, such as cabbage or rape, and on the less stiff soils mangolds. A crop that can be transplanted instead of being sown will usually do best on such difficult soils.

Yorkshire.—On the rich, heavy lands of Holderness the rotation generally followed is somewhat as follows :—Wheat, barley, beans and bare fallow, wheat, barley, turnips and "seeds." The farms comprise also considerable areas of grass land, and stock raising is largely followed. In the case of most heavy-land rotations, wheat is the staple crop; beans are less dependable, though in a favourable year they yield a profitable direct return and are further valuable as nitrogen collectors.

Sussex.—On some of the heavy alluvial soils of Sussex which are mostly under the plough, the following six-course rotation is followed :—

1. Wheat ; 2. Oats ; 3. Roots ; 4 Oats ; 5. Wheat , 6. "Seeds."

Catch crops are introduced wherever possible, the corn stubble being quickly broken up and sown with rye, winter barley, trifolium or vetches, which are eaten off by sheep and followed with late turnips or rape. Where sheep are kept they are usually folded on permanent grass during wet weather in winter.

Most of the crops are sold, and the fertility has consequently to be maintained by artificials and the cake fed to the sheep when folding. A special local industry—poultry cramming—provides a ready market for oats. Here, as elsewhere, stock are subordinated to crops when a good market for the latter is available.

Carse of Gowrie.—On the stiffish alluvial tract known as the Carse of Gowrie, in Scotland, the following eight-course rotation is generally followed :—

1. Oats ; 2. Beans and potatoes ; 3. Wheat ; 4. Turnips ; 5. Barley ; 6. "Seeds" (hay) ; 7. Grass ; 8. Grass.

Occasionally a bare fallow is taken The beans are usually spring sown, sometimes pure, sometimes sown with oats and peas. Part of the area is usually cut green and fed to bullocks, the rest being ripened and harvested. Sometimes pure timothy is sown instead of grass and clover, and is cut for hay. Few stock are reared. Bullocks and sheep are bought in, the former being fed off on grass and roots, while the latter are utilised to consume the aftermath.

In the case of most heavy-land rotations, the relatively long interval between recurring cleaning (root) crops tends to encourage weeds (*e.g.*, wild oat), but this difficulty is in some

districts overcome by taking two root crops, generally mangolds, in succession, and a bare fallow is thereby obviated.

Small Holdings.

The arable land best suited to the small holder, or at all events the land on which he can compete most successfully with the larger general cultivator, is, as a rule, flat and capable of being worked in almost any weather. It should be near a railway station and not too far from the big centres of population, so that good markets are assured and town manure may be available wherewith to supplement his usually short supplies ; since, apart from pigs and poultry he will, as a rule, keep few live stock. Such conditions are those of the Sandy and Biggleswade small cultivators. Here, as in most other places where markets are readily available, the cultivator follows no hard and fast rotation, but grows such field produce as will meet the readiest sale, and tries as far as possible to keep his land always under a crop, for if left any time uncropped, it will quickly be overrun with weeds. Early potatoes, Brussels sprouts, cabbages, parsnips, carrots, parsley, marrows, kidney beans, onions, and similar crops, are chiefly grown, while oats and clover are occasionally grown by way of a rest by the larger holders.

Up to the present London dung is still procurable, though at ever increasing prices, and here and elsewhere, under similar conditions, attention will have to be directed to green manuring, for such thin and hungry soil must be kept constantly replenished with organic matter. The chief objection to this on highly rented land is that it necessitates a crop from which there is no immediate and direct return. The difficulty, however, must be faced, and might to some extent be minimised by growing clover for sale as hay, and ploughing in the aftermath. A rotation in which peas find a regular place would also seem advisable. On the light "heath" lands of Lincolnshire where the farms run large, the blue wrinkled marrowfat pea occupies a definite place in the order of cropping. Little dung is used, but a two years' crop of grass is taken on which sheep receive cake.

Fen lands are also very suitable for the small holder, for the soil is easy to work, naturally rich, and productive even in a dry season. Crops yielding a relatively big return and peculiarly well suited to the resources of the small holder and his family can be successfully grown on such land, *e.g.*, potatoes, carrots, celery and similar crops.

On heavy land the small holder is, more than ordinarily, at a disadvantage as compared with the larger cultivator in

the growing of the crops usually considered best fitted for such land. His horses and his cultivating implements are generally not such as will enable him to work his land as effectively as his larger competitor. In his present rigid individualism he is less favourably situated when it comes to purchasing and selling commodities. He is not in a favourable position to breed high class stock, and seldom possesses sufficient stock to consume surplus vegetable produce. When a station is within easy driving distance and the large towns are not more than a hundred miles distant, he will probably be well advised, unless he has had training for other specialised work, to devote his energies to milk production—retailing it where practicable In some localities, where the small holder can convey his milk to a factory, cheese-making provides a satisfactory outlet for milk. On heavy land, only such portion should be ploughed up as will yield a moderate winter allowance of mangolds, cabbages and similar crops, and provide sufficient winter fodder. A mixture of vetches, peas, and oats is valuable in this respect. Part may be cut and fed green or made into hay, and the remainder allowed to ripen, when both an excellent fodder and a high-class feeding mixture may be obtained, and with far more certainty than a crop of roots.

On some grass holdings of 50 acres and upwards, even one cow to two acres may be kept, but the produce of such holdings has to be considerably augmented by the purchase of feeding stuffs. In the case of those heavy-land holdings where milk-selling is impracticable, the small holder and his family should devote themselves to the branches of industry usually more or less neglected by the larger farmer, such as the rearing of calves, pigs and poultry, and the growing of peas, broccoli, Brussels sprouts and the like.

Butter-making is not usually very profitable, unless combined with calf-rearing or pig-keeping, but in this connection it might well prove a helpful factor in the aggregate of a small holder's activities. The scarcity of store cattle and of dairy cows, and the high prices current for both these classes of stock, would seem to point to a suitable field for the energies of a small holder and his family. Nothing is better than milk for rearing, and it should be the aim of the rearer to make this valuable product go as far as possible. If butter be made, the skimmed or separated milk should be fed along with a cream substitute or other suitable food. Cod-liver oil, cotton-seed oil, linseed, and oatmeal or ground oats, have all been successfully employed in this connection. If butter cannot be sold to advantage, the most economic utilisation of the milk

would probably be effected by having the cows hand-milked, and the product, suitably supplemented with other food, meted out at the rate of three or more calves per cow. After weaning, the heifers might be kept cheaply by being run out to grass practically the whole year round, receiving just sufficient food to keep them in good thriving condition, and they might be sold in calf or just calved at about two years and three months old. The bullocks might either be sold as stores or fed off fat on grass at about two years old. The success of this system would depend largely on the type of stock dealt with. Probably the shorthorn of the Cumberland type would be found to answer best.

SALE OF MANURES IN SMALL QUANTITIES AT EXCESSIVE PRICES.

The attention of the Board has recently been directed to the comparatively high cost to the purchaser of small lots of artificial manures. The manipulation of small quantities by sellers involves extra packing, a higher proportional cost of carriage, additional warehousing, and other items incidental to retail trade, and this adds greatly to the cost as compared with that of large consignments obtained direct from the manufacturer.

For example, the following prices (carriage paid) for Kainit appear on a current price list: 1*s.* 6*d.* for 7 lb., a price equivalent to £24 per ton; 2*s.* 6*d.* for 28 lb., =£10 per ton; 6*s.* for 1 cwt., =£6 per ton; 27*s.* 6*d.* for 5 cwt., =£5 10*s.* per ton. Four or five tons of Kainit could probably be obtained in most districts at the rate of about £2 15*s.* per ton. The prices of Sulphate of Ammonia are quoted as 2*s.* 3*d.* for 7 lb., =£36 per ton; 5*s.* 6*d.* for 28 lb., = £22 per ton; 19*s.* 6*d.* for 1 cwt., =£19 10*s.* per ton; 92*s.* 6*d.* for 5 cwt.,=£18 10*s.* per ton. Four or five tons of Sulphate of Ammonia could probably be purchased in almost any district at about £14 per ton. Large wholesale firms do not as a rule quote for less than two-ton lots, and a quantity of even 5 cwt. may cost two or three times as much per ton as a truck load consigned to the same destination. The adoption of co-operative methods appears to be the only way by which those who need small quantities of artificial manures can avoid the payment of relatively high prices.

The extra cost to the small buyer may be even greater in the case of mixed manures than in the foregoing instances. Where such manures are sold in tins and packages, allowances must be made for the necessary expenses involved in this mode

of dealing, but cases not infrequently occur when the prices charged suggest that the profits must be very high, or that the expenses incurred in advertising, etc., must be such as no consumer should be expected to pay for.

Thus, a much advertised mixed manure, which in bulk might be manufactured for £6 per ton, is quoted at 30*s.* per cwt., and the same material in shilling packets was found to contain about as much fertiliser as would cost a farmer using artificial manures in quantity one halfpenny. The manure in question is a good one apart from the price, and if 1 cwt. could be obtained for not more than 10*s.* to 12*s.* per cwt., it might usefully be employed in manuring one-eighth of an acre of potatoes, but the cottager cannot afford to pay from three to four times the farmer's price.

How then is the small grower to purchase manures to the best advantage? The importance of co-operative methods has already been referred to in this connection, but there are other considerations which require his attention.

It is generally known that the vendor of artificial manures is bound by law to state on the invoice the percentage of nitrogen, soluble phosphate, insoluble phosphate and potash contained in such manures and that machinery is provided for the enforcement of this obligation and to test the accuracy of the analysis given. This analysis affords a ready means of roughly determining the value of a manure, but, as the Board have repeatedly explained, the mere fact that a correct analysis is given is in no way a guarantee that the manure is worth the price asked for it. Unless the purchaser goes to the trouble of making the simple calculation necessary he might almost as well not have the analysis at all. If an intending purchaser is offered a certain mixed manure containing any or all of the above-mentioned ingredients, he should as a safeguard, ascertain its value per ton by multiplying the current unit price of each (published monthly in this *Journal*, see pages 1038-9) by the percentage of the corresponding ingredient contained in the manure (see Valuation of Manures, Leaflet No. 72).

Apart from the question of cost, the purchase of compound manures is, as a general rule, to be deprecated, as the best results can only be obtained by studying the requirements of each kind of plant and manuring accordingly. In a garden it is, however, useful to have a mixture which can be safely used in fairly large quantities for most quick-growing plants, and may be relied on to give satisfactory—even if not the very best—results. Even in large gardens where more detailed

attention can be given, it is often convenient to have in stock a standard all-round mixture which can be supplemented for special crops as desired. Such a mixture might be cheaply prepared as follows :—

1	part	(by weight)	Sulphate of Ammonia (" 95 per cent. pure.")
6	parts	,,	Superphosphate (" 26 per cent. Soluble Phosphate.")
1½	,,	,,	Bone Meal (finely ground.)
1½	,,	,,	Sulphate of Potash (" 90 per cent. pure.")

The mixture when freshly prepared would have a composition approximately as follows :—

Nitrogen	2.6 per cent.
Phosphate (Soluble)	15.6 ,,
Phosphate (Insoluble)	7.5 ,,
Potash	7.25 ,,

The mixing should be carefully and thoroughly done, and lumps should be crushed · if possible the whole should be passed through a sieve of about ⅜ inch mesh. The use of bone meal keeps the mixture in a good powdery condition. A certain amount of reversion in the soluble phosphates will take place, but for gardening purposes this does not substantially alter the value of the manure, and if stored in a dry place the mixture will keep for years without material deterioration. Even if excessive quantities are unintentionally applied the risk of serious damage to ordinary plants is not great, but unless the use of manures is well understood, in no case should 1 lb. to four square yards, approximately 11 cwt. per acre, be exceeded.

MANURING FOR HAY.

GERVAISE TURNBULL, F.L.S.

THE evidence for and against artificial manures as a substitute for dung has been accumulating for some years past, and the results of the most important experiments, together with some others conducted during recent years, are summarised in the accompanying tabular statement. They form an instructive commentary on the well-known possibilities of improving meadow land at a moderate cost

All the figures have been recently published, and in some cases include 1912 returns. They have been taken, in many cases, direct from the published figures, supplemented by information as to soil kindly supplied by correspondence, while the remainder are from the summaries published in this *Journal.*

The figures as to "increase" and profit have, in a number of cases, where not given in the original reports, been worked out by the writer, and have been repeatedly checked, and every care has been taken to ensure accuracy and uniformity, while trifling fractions have been omitted. The same series appears under the different manurial headings, with the exception of some of the Staffordshire and Yorkshire and the Kineton centres. Duplicate plots are unfortunately extremely rare.

Comparison of Profits.—In comparing respective profits one or two points deserve special attention. One of these is the amount of money which should fairly be charged against dung when it is not used yearly. It is obviously incorrect to charge the whole, and still incorrect to charge only one-quarter in the first year of four. It is suggested that one-half or three-fifths the value is much nearer the truth, probably the latter. Something should also be charged for labour and haulage, even though this is not usual in the case of artificials, at any rate in annual applications. This, however, never seems to be done. It is taken at 5s. per ton, except where stated.

Value of Hay.—Hay is generally valued at 50*s* per ton, and this standard has been adopted where calculations have had to be made by the writer. In the Bucks and Oxon trials, however, it is put at 60*s*., in East Suffolk at 40*s*, and in Cockle Park, Sevington and Cransley at the low figure of 30*s*. The land being very poor at Cockle Park, the sum of 30*s* is adopted by the writer for the other two stations, which are duplicates of Cockle Park. It should probably, however, be put at a higher rate at Sevington, where better herbage is produced than at the other two stations, which are very similar in this respect Another exception, noted in the tables, is Palace Leas (Cockle Park), where the plan of basing the value of the hay on its quality has been adopted, certainly a more correct method, the range being 18*s*. It should further be noted that the experiments mentioned above at these three now famous stations are manured on pasture lines, and, unlike other stations, the plots changed yearly.

The size of the plots is $\frac{1}{20}$ acre in the Leeds, Wilts, and Cockle Park (Palace Leas $\frac{1}{2}$ acre) group, but up to 4 acres in the manuring for milk tests. This information is not always given in the reports, which might be regarded as much more valuable in most cases if fuller particulars were furnished, especially as to soil, including its condition as regards lime.

So far as can be gathered, the time of application of the manures is winter or early spring, nitrogenous fertilisers rather later.

Results.—The satisfactory returns from a complete manuring,

and from potash and phosphates combined, form the most consistent feature. Potash and phosphates, on the data given, seem to be more profitable than a combination of either with nitrogen, over a fairly wide range of soils. Slag is blamed when at fault, often probably because it is used alone; results show that the addition of kainit is sometimes an improvement on heavy as well as on light land. The results obtained from superphosphate and sulphate of potash are very noticeable, probably giving the highest average, and are remarkable in showing again how useful potash may be on heavy land. In a complete dressing the sulphate would seem to be rather more profitable than kainit, according to the results obtained at the limited number of centres included, which, however, are not strictly comparable, the locality and sometimes the soil being different. There is, however, little to choose between superphosphate-kainit-nitrate, slag-kainit-nitrate, and superphosphate-nitrate-sulphate of potash.

When artificial manures are used with dung we find more uncertainty in a "complete" combination than we do when dung is omitted, and a lower average profit in the limited data to hand, the dung itself paying better than the combination used in intervening years. This is significant, and suggests that the amount charged against it (½) is insufficient. The application of dung and artificials in alternate years seems to pay no better than their use at a longer interval. Soil analysis is of some use as a guide to manuring, but it will be found that it is by no means an infallible guide, and may easily prove misleading (*cf.*, the Oxon results), where soils showing the higher potash or phosphate content respond better than those showing lower ones, though a combination of these two fertilizers may be useful. In other cases, where one or other of these constituents is deficient, (*cf.*, Bucks) the compound manure is not materially beneficial, though it is so when both constituents are deficient. A mixture is seen to be generally superior to a single manure. Nitrate of soda, for example, may have far more effect with one or two other artificials than it has alone, whether the land responds separately to the others or not. This is the case in the Bucks centres. On the other hand a mixture may turn out much worse than its constituent parts, as was found at one centre with kainit and slag, the mean being struck at another. Nitrate of soda and basic slag furnish a good instance of the value of combination. In Oxfordshire either, separately, did very badly and caused a loss, whereas, used in conjunction, 3*s.* 7*d.* profit was realised. Broomhaugh is a noted example of this. Basic slag and kainit in the

same places behave in a similar manner, but at two other centres the position is reversed.

A glance at the tables (p. 986) shows that the profitable use of potash is not confined to light land, more particularly when phosphates accompany it. As regards liming the somewhat meagre particulars at hand indicate that this has considerable effect, chiefly in improving the use of superphosphate. It gave an additional profit of 12*s*. per acre at Cransley, but sometimes it is not at all profitable. Except on rich old pasture its use without phosphates is probably not economical. As regards the effect of soil lime on manures, basic slag certainly seems to be superior to superphosphate where lime is present to the extent of 1 per cent. or under, as on arable land, but the inference is drawn mainly from heavy land. Basic superphosphate, however, sometimes gives much better results in the absence of soil lime (Bucks: lime is especially deficient here).

Judging by the results in three of the main series of experiments the effect of soil lime on kainit seems to be negligible or unimportant. The action of nitrogenous manure, including dung, is often independent of the amount either of organic matter or nitrogen contained in the soil, though there is some tendency towards a relationship in the case of dung. The success of basic slag, too, is often not connected with either the amount of organic matter present or the soil moisture.

As regards the larger question of the effect of manures on the quality of the grass or hay, it is quite clear that this is a factor that should be reckoned with, and that the arbitrary figure of 50*s*. a ton is but a rough guide. This has been clearly shown at Cockle Park, where the hay results by no means necessarily coincide with the live-weight tests, and, as regards hay values based on this excellent test, there is a wide range, as already stated. It is sufficient to mention that the striking minus results recorded from muriate of potash in various combinations have changed into positive figures in three cases out of seven where quality is made the basis of valuation. Akin to this is the question of aftermath, which, in some cases, qualifies the figures as to profits in the schedule, according to the manure used. This is a point of practical importance apt to be overlooked. Aftermath from dung, for instance, may be decidedly more plentiful than that accruing from artificials. Another point of importance is the fairly uniform high return which a small dressing of dung appears to be able to give.

The figures given in columns 7, 8 and 9 of the tables are all per acre.

A —*Complete Manuring*

Manures used.	Locality.	No. of Centres.	Soil.	No. of Years.	Amount used in cwt. per acre.**	Yearly Hay yield in cwt.	Average Increase.	Profit.	Remarks.
Super., Kainit, and Nitrate.	Irish Dept. of Agric.	11	8 Counties . ..	10	2 2 1	48	17	24/–	Found best yield and profit.
	Oxon ..	2	Heavy loam and Oxford clay.	2	5 3 1	40	17	18/2	——
	Bucks.. .	2	1 ,, ,,	4 & 5	5 3 1	—	—	11/6	Loss 19/9 1 centre.
	Newton Rigg	—	—	14	3 1½ ¾	40	10	Estim. 15/– to 20/-	Applied triennially.
	Leeds .	2	1 rather light ..	11	C3 3 1½	49	14½	5/1	Another series.
	Leeds	6	Mostly thin and dry	8	A2 3 2	39	18	12/4	Best proportions.
	,,	6	½ light ½ strong loam, etc	8	B2 3 1½	37½	12½	4/–	Another series. Sulphate of Ammonia series neutral.
	,,	6	Mostly thin and dry	8	A2 3 1½	36	15	10/6	——
	,,	6	,, ,,	8	A2 3 1	34	13	9/10	——
	Broomhaugh	11	Light, sandy .	—	—	—	—	1/6	3/4 loss with Sul. Ammonia.
Nitrate, Slag, and Kainit.	Staffs .	1A	Strong clay on clay	12	1 5 3	46½	16⅔	11/2	The highest return from artificials, and the most profit.
	,,	1B	Medium black loam on gravel	10	,,	40½	14	6/–	
	,,	1D	Strong loam, rather wet.	4	,,	37¾	11	5/–	
	Bucks .	10	Various	4–5	1 5 3	—	13	10/10	,, ,,
	Oxon .. .	6	Clay type mostly	2	1 5 3	41½	12	6/4	Ditto, 2nd highest profit.
	,,	7	,, ,,	3	,,	35½	12½	7/6	2nd Ditto, highest profit. Super. at 2 centres.

	Leeds	2	1 light	8	1½ 2 3	45	10	−2/−	Loss.
	Broomhaugh	11	Poor, light, sandy	—	1 3¾ 2⅝	—	—	13/6	Beat other manures and combinations hollow, save Slag and Kainit.
	E. Suffolk C. C.	1	Extremely poor clay	9	1 5 2	25½	15	25/4	
Slag, Sul. Pot., Nitrate.	Leeds	2	1 rather light, sandy subs, poor in lime.	8	2 ¾ 1½	—	—	—	——
	Kineton	1A	Stiff	—	5 1 1½	43	30	Estim. 30/− to 35/−	——
	Salop	1	Heavy clay	8	2½ ⅓ 1⅐	39	16	17/4	One of the best.
	Staffs	2	Sour peaty loam, gravelly on rock	4	,,	39½	13½	15/−, 5/−	Marked improvement in quality at one centre.
Super., Sulphate of Potash, Nitrate.	Kineton	1B	Heavy. Was very poor at the start	11	3 1 1½	40	29	Estim. at £2.	Practically same without Potash.
	Leeds	2	1 light	11	3 ¾ 1½	45½	11	5/6‡	——
	Rothamsted	—	Heavy	53	3½ 5½ 4½	61	39½	Loss (?).	Best within limits.
Kainit, Steamed Bone Flour and Nitrate.	Leeds, 1902–9	2	1 light	8	3 1¼ 1½	45½	—	−3/6 ‡	Loss like all other combinations of B. Flour, including Sulp. and Mur. Pot. with Nitrate, 5/− and 6/−, all reduced subsequently.
	,,	2	1 light	11	,,	46½	12	−2/− ||	
Super, Muriate of Potash, Nitrate.	Leeds	2	1 light	8	3 ¾ 1½	49	14	Abt 13/−‡	
Slag, Muriate, Nitrate.	Leeds	2	1 light	8	1¾ ¾ 1½	47½	12	3/−‡	Last 4 are same series.
Slag, Muriate, †Sul. Ammonia.	Cockle Park (Palace)	1	Heavy clay	15	2½ 1 1⅔	30	11½	3/11	Hay at 55/−
Slag, Muriate and Nitrate.	,, ,,	—	,, ,,	,,	,,	31	12	2/10	Hay at 53/−

† This mixture with Super. instead of Slag gave excellent results on seeds hay in the Midland College trials a year or two ago.
‡ 1909 prices for manure. || 1913 prices for manure. ** The figures in this column represent cwt. per acre of the fertilizers mentioned in the first column, in the same order. A, B, C, and D in columns 3 and 6 indicate separate series of experiments.

A.—*Complete Manuring*—continued.

Manures used.	Locality.	No. of Centres.	Soil.	No. of Years	Amount used in cwt. per acre.†	Yearly Hay yield in cwt.	Average Increase	Profit.	Remarks
Slag, Kainit, Sul. Ammonia.	Broomhaugh	—	Light, sandy .	—	$2\frac{5}{8}$ $3\frac{3}{4}$ $\frac{3}{4}$	—	—	−3/4	Good aftermath.
Super., Kainit, Sul. Ammonia	Wilts, 1911	5	Mostly cold poor clay	1	$2\frac{1}{8}$ $1\frac{3}{8}$ $\frac{7}{8}$ 3 $1\frac{3}{8}$ $\frac{7}{8}$	25—42	$2\frac{1}{2}$—11	Up to 13/3 $\frac{1}{2}$ loss, $\frac{1}{2}$ gain.	1 loss. Worse than Slag in each case by 2/1 (chalk), to 15/– (clay.)

B.—*Potash.*

Manures used.	Locality.	No. of Centres	Soil.	No. of Years	Amount used in cwt. per acre.†	Yearly Hay yield in cwt.	Average Increase	Profit.	Remarks.
Slag and Kainit	Oxon .	7	Mostly clay type	3	5 3	31	8	4/7	Highest profit.
	Bucks. .	10	Various	4, 5	5 3	—	$8\frac{1}{2}$	7/–	5th ditto, up to 31/6.
	Broomhaugh	—	Light, sandy	11	$3\frac{3}{4}$ $2\frac{5}{8}$	—	—	13/11	Highest profit. The only dressing.
	Wilts, 1911	5	Heavy . .	1	$2\frac{1}{3}$ $1\frac{3}{8}$	—	Up to 10	8/8	One of the best.
	E. Suffolk C. C.	1	Exceedingly poor clay.	9	5 2	25	15	25/6	Slag triennially. Kainit, 1909.
	,, ,,	1	,, ,,	9	10 2	$29\frac{1}{2}$	$19\frac{1}{2}$	33/2	Slagged twice, ditto.

Super and Kainit	Wilts, 1911	—	Heavy .	—	—		—	—	—	Poor, Slag better.
	Leeds .	6	Mostly thin and dry	8	2	3	28	$6\frac{1}{2}$	4/5	——
	Lancs ..	8	—	2	—		—	$8\frac{1}{2}$	—	——
Super. and Sul. Potash	Salop	1	Stiff clay loam ..	8	$2\frac{1}{2}$	$\frac{1}{3}$	36	13	22/6	Highest profit.
	Staffs	2	Sour peaty loam, and gravelly on rock.	4	$2\frac{1}{2}$	$\frac{1}{3}$	—	—	—	Quite moderate only.
	„ 1910–11	1	Strong clay ..	2	„		—	$11\frac{1}{2}$	17/–	——
	Cockle Park	1	Poor clay ..	9			18	9	6/8	Practically no gain over Super.
	Cransley ..	1	„ ..	8	7	2 at intervals.	$22\frac{1}{2}$	16	14/2	2nd highest, 10 cwt. p. a. over Super.
	Sevington .	1	Chalk and mixed	9			33	$13\frac{1}{3}$	12/10	Equal to ditto, 5 cwt. p. a. over Super.
	Midland College	1	Strong clayey .	3	'09 4	$1\frac{1}{2}$ $\frac{1}{2}$ ton lime.	—	—	"Handsome"	Manuring for milk.
	Harper-Adams Coll	1	Stiff clay loam	8	$2\frac{1}{2}$	$\frac{1}{3}$	—	—	22/5 *	Ditto, Super only. Hay, 20/7.
	Kineton ..	1B	Heavy . ..	10	3	1	$31\frac{1}{2}$	$20\frac{1}{2}$	Estim 33/–	Only 1 cwt. over Super. Same thing in complete dressing.
Slag and Sul. Potash	„ .	1A	„	10	5	1	$35\frac{1}{2}$	$22\frac{1}{2}$	Estim. 35/–	——
Kainit and Nitrate	Staffs ..	Various	Strong clay, black loam	12, 4, 10	3	1	—	Up to 11	Up to 9/–	Among the best.
	Oxon ..	—	Mostly clayey ..	—	3	1	30	$6\frac{3}{4}$	2/8	——
	Bucks ..	—	Various	4, 5	3	1	—	$8\frac{1}{2}$	8/3	——
	Broomhaugh	—	Light, sandy ..	—	—		—	—	—	Loss.
	Leeds ..	6	Mostly thin and dry	8	3	$1\frac{1}{2}$	34	9	4/6	——

* This profit was greatly increased in 1912. † See footnote ** p 985.

B.—*Potash*—continued.

Manures used.	Locality.	No. of Centres.	Soil	No. of Years	Amount used in cwt. per acre.*	Yearly Hay yield in cwt.	Average Increase.	Profit.	Remarks.
Kainit and Sul. Ammonia.	Wilts, 1911	5	Light and heavy ..	1	$1\frac{3}{8}$ $\frac{7}{8}$	—	—	−7/1 to 16/–	Only fair, best on light soil.
Kainit alone	,, ,,	4	Strong, poor clay .	1	$1\frac{3}{8}$	—	Up to 8	13/6	16/10 highest profit of 11 plots.
	,, ,,	1	Chalk	1	—	—	—	−2/7	—
	Staffs	Various	Strong and lighter	4, 10, 12	$1\frac{1}{2}$ 3	—	—	—	Quite poor or bad.
	Oxon	7	Mostly heavy clay	3	3	25	2	−1/5	—
	Bucks	10	Various . .	4, 5	3	—	$4\frac{1}{2}$	6/3	20/6—16/–, 3 centres.
	Broomhaugh	—	Light, sandy	11	—	—	—	—	Loss.
Potash	Cumberland	—	Great variety .	—	—	—	—	—	Profit in all cases but one.
Muriate of Potash.	Cockle Park (Palace)	—	Poor clay . ..	15	—	—	—	—	Loss in 6–7 combinations and separately used.
Sulphate of Potash	Staffs and Salop	3–4	Heavy and light	1, 4, 9	$\frac{1}{3}$	—	−2 to 7	—	—
Muriate, Slag and Super.	Armstrong Coll.	1	Sandy loam . ..	5–6	—	—	—	—	The most satisfactory.
		1	Gravelly loam ..	5–6	—	—	—	—	Profitable.

* See footnote ** p. 985.

C.—*Nitrogen and Phosphate*

Manures used.	Locality.	No of Centres.	Soil.	No. of Years.	Amount used in cwt. per acre.*	Yearly Hay yield in cwt.	Average Increase.	Profit.	Remarks.
Nitrate and Slag	Broomhaugh	—	—	—	—	—	—	—	A loss.
	Bucks.. ..	10	Various	4, 5	1 5	—	10¼	9/4	—
	Oxon ..	—	Clayey . ..	3	1 5	31½	8½	3/7	—
	Staffs ..	3	Strong, loamy ..	4	1 5	to 39½	to 11	to 7/-	—
	Kineton ..	1A	Heavy type. .	10	1½ 5	42½	29½	Estd. 45/- to 50/-	Sul. Pot. gave ½ and 1 cwts. inc. Best results and best herbage.
Nitrate and Super.	Kineton .	1B	Heavier .	10	1½ 3	39	28½	Estm. 45/- to 55/-	,, ,,
	Staffs ..	2	Peaty and gravelly	4	1½ 2½	36	9½	—5d.	Peat sour.
	Leeds (Garforth)	1	Mostly light and dry.	11–12	1½ 2	40½	—	8/11†	—
	,,	6		8	1½ 2	32	8	7/2	—
	,, ..	6		8	1½ 2	35¾	10¾	6/3‡	Another series
	,, ..	2		10	1½ 3	44½	10	1/6	,, ,,
Super. and Sul. Ammonia.	Wilts, 1911 .	5	Mostly poor clay..	—	3 ⅞	—	—	—	Some loss, poor, Slag much better.
	Leeds ..	—	½ light, ½ heavy ..	—	2 1⅛	34	9	3/8	—
	Cransley, Sevington and Cockle Pk.	—	—	—	—	—	—	—	Fairly good.
Slag and Sul. Ammonia.	Wilts, 1911 .	5	Heavy and light..	1	2⅛ ⅞	—	—	Up to 16/4	One of the best, chalk and heavy land.
	Cockle Park (Palace)	1	Heavy	15	2½ 1⅜	30	11	4/4	—

* See footnote ** p. 985. † 1912 prices for manures. ‡ 1910 prices for manures.

D.—*Phosphate alone.*

Manures used.	Locality.	No. of Centres	Soil	No. of Years.	Amount used in cwt. per acre *	Yearly Hay yield in cwt.	Average Increase	Profit.	Remarks.
Slag .. .	Wilts, 1911	*5*	Mostly poor clay	*1*	—	—	—	—	The better in each combination and separately
Super. .	Kineton ..	—	Heavy	10	3	30½	20	Estim 42/6	—
Slag	,,	—	—	*10*	*5*	*33½*	*20½*	*Estim 40/-*	—
Super .	Westmor-land	1	Sandy loam .	1	—	—	—	—	Both good, Super. best.
Slag .	,,	*1*	Gravelly loam	*1*	—	—	—	—	Slag only profitable. Land deficient in lime.
Super. (basic) .	Oxon	7	Mostly clayey	3	4	—	4⅓	−5d	25/10 (2 years) and 18/9 2 centres.
Slag	,,	—	—	*3*	*5*	—	*4*	*−4d.*	—
Super. (basic) .	Bucks ..	10	Various	4—5	4	—	5½	4/6	23/- profit in one case.
Slag .	,, .	*10*	,,	*4—5*	*5*	—	*7*	*9/9*	—
Super.	,,	2—3	,, ..	4—5	5	—	—	—	—
Slag	Broomhaugh	—	Light, sandy	—	—	—	—	—	Loss.
Super	Cockle Park, Sevington and Cransley.	—	—	—	—	—	—	Av. 6 9	—

* See footnote ** p. 985.

E.—*Dung and Artificials.*

Manures used	Locality.	No. of Centres	Soil	No of Years.	Amount used in cwt per acre *	Yearly Hay yield in cwt.	Average Increase.	Profit.	Remarks.
			(1) Dung every 4th year, 10 tons, ¼ charged yearly, 5/– ton.						
Dung 4th year	Salop . . .	1	—	8	—	33	10½	13/11	—
Super., Sul. Pot., N. Soda other years.		—	Stiff clay loam . .	8	2½ ⅓ 1⅐	41	18	16/–	—
Dung 4th year	Staffs . .	1	—	4	—	37½	11	15/–	—
Super., Sul. Pot., N. Soda.		—	Sour peaty loam	—	2½ ⅓ 1⅐	37	11	–7/6	—
Dung . .	,, ...	1	—	4	—	38	11	15/–	—
Artificials as above		—	Gravelly on rock	4	2½ ⅓ 1⅐	42	14½	1/3	Highest yield.
Dung 4th year	Staffs . .	1	—	4	—	31½	4½	–1/3	Loss. Cost 12/6.
Slag, Kainit, N. Soda other years.		—	Strong wet loam .	—	3⅜ 1½ 1⅐	36	10	–10/–	Loss. Cost 35/1.
Dung . .	Cockle Park (Palace).	1	Poor clay . . .	15	16 tons.	34	15	2/2	—
Sul. Am., N. Soda. Slag, Mur. Pot.		—	—	—	⅓ ½ 1½ ½	—	—	—	—

* See footnote ** p. 985.

E.—*Dung and Artificials*—continued.

Manures used.	Locality.	No. of Centres	Soil.	No. of Years.	Amount used in cwt. per acre.‖	Yearly Hay yield in cwt.	Average Increase.	Profit.	Remarks.
			(2) Dung every 3rd year.						
Dung	Newton Rigg	—	—	—	10 tons	—	—	—	—
Nitrate, Kainit, Super. other years.		1	—	14	¾ 1½ 3	40	10	—	—
			(3) Dung and artificials alternate years *						
Dung and N Soda, Super., Kainit.	Leeds ..	6	½ light and dry (1) ½ heavy	—	1½ 2 3	40½	15½	2/9†	—
,, ,,	— Garforth	1	Light	14	1½ 2 3	51	23	£1/1/6†	—
	Cockle Park	1	Heavy . .	15	8 tons Dung	33½	14½	8/3	—
Dung and N. Soda.	Garforth ..	1	Light	14	1½	49	21½	£1/3/9†	—
	Leeds .	6	As above (1). ..	8	—	38½	13½	3/9†	—
Dung, N. Soda, Super.	Garforth	1	Light, sandy .	14	1½ 2	49	21	£1†	—
	Leeds	6	As (1)	8	1½ 2	39	14	2/6†	—
Dung and Slag..	Armstrong Coll. and Westmorland.	1	Sandy loam . ..	5—6	10 tons(?)	—	—	—	Not profitable, but aftermath better than dunged.
,,	,,	1	Light, waterlogged	5—6	10 tons (?)	—	—	—	‡Apparently profitable.

* ½ cost of each charged yearly, 10 tons.

† Cost of artificials, 1910, Dung 10 tons at 4/6.

‖ See footnote ** on p. 985.

‡ Artificials only not profitable.

F.—*Dung only*

Manures used.	Locality.	No. of Centres	Soil	No. of Years.	Amount used per acre.	Yearly Hay yield in cwt	Average Increase.	Profit.	Remarks.
Dung in alternate years	Garforth ..	1	Light, sandy	14	10 tons.	46	18	£1	—
	Leeds .	6	½ light, ½ heavy	8	10 tons.	34½	9½	−1/3	—
	Cockle Park (Palace).	1	Poor clay	—	8 tons.	30	11	7/6	—

G.—*Nitrate of Soda*

Manures used.	Locality.	No. of Centres.	Soil	No. of Years	Amount used in cwt. per acre.*	Yearly Hay yield in cwt.	Average Increase	Profit.	Remarks.
Nitrate of Soda	Leeds	6	½ heavy, ½ light	8	1½	—	—	7/-	—
	"	11	Light, etc.	2	1½	—	—	4/-	Another series.
	Bucks.. .	4, 5	Various	10	1	—	—	3/6	—
	Oxon .	7	Clayey	3	1	—	—	−4/-	Loss.
	Kineton	1B	Heavy ..	11	1½	29½	18½	Estim. 31/-	Unmanured 11 cwt.
		1A	—	10	1½	33	20	—	—

* See footnote ** p. 985.

Poisoning by Conifers.

THE Board have recently received an enquiry as to whether certain species of *Cupressus* and *Abies* are poisonous. The only Conifer which commonly causes poisoning of live stock is the Yew, but injury might more frequently occur were it not for the fact that Conifers generally are unpleasant to the taste, and are hence avoided by stock. Many species, however, contain *Tannin, Resins* and *Gums, Volatile Oils,* and an *acrid substance* which may cause inflammation of the digestive and urinary tracts, while Tanret found in the young shoots of *Picea* the glucoside *Picein.* It is quite possible that if eaten in quantity the foliage of some Conifers may induce poisonous symptoms and even death in the animals concerned. It is noteworthy, however, that according to Pott the needles of *Picea excelsa, Abies pectinata, Larix Europæa,* and *Pinus* sp. are, in the mountainous districts of Steiermark, Kärnten and Tyrol, extensively fed to cattle and sheep, usually as a supplementary food, either fresh or dried and ground up—chiefly perhaps as an appetiser, and in small quantities as a dietetic; *Juniperus* sp. are similarly utilised in some districts. It is not known to what extent the foliage may be fed without harmful consequences, but Pott states that large quantities can cause hæmaturia and similar effects, and hence only small quantities should be used, and even so may impart a bad flavour to the milk of cows All green needles frequently cause digestive troubles.

The foliage of the Yew (*Taxus baccata*) is well known, in certain stages, to be dangerously poisonous to stock, and has caused many losses.

In regard to *Cupressus* the only cases of poisoning which have been traced are recorded in this *Journal* (October, 1905). In one case four bullocks died, and there was little doubt that the cause of death was irritant poison. Some pieces of *C. macrocarpa* were found in their stomachs, and in default of any other explanation it was suggested that this plant might have poisonous properties.

In another instance three heifers were stated to have suffered from irritant poison; one of them died, but the other two recovered on removal to another field. The veterinary surgeon in this case attributed the death to a Cupressus (*C. nootkatensis*) growing by the side of the field.

The Board have no information as to the poisonous properties of these two species, nor can any record be found of any similar case which would tend to confirm the suspicion that they are poisonous to cattle.

Marram Grass for Paper-making.

THE suitability of the Common Marram Grass of our coasts for paper-making was discussed in a note in this *Journal* for February, 1913, p. 935, which gave the yields of unbleached and bleached fibres obtained from samples of this grass in trials conducted by the firm of Messrs. Clayton Beadle and Stevens.

This firm has since extended its experiments on the utilisation of the fibre for paper-making, and the following are the results obtained (*Kew Bulletin*, No. 9, 1913) :—

	Per cent.
Green Stem—	
Yield of dry uncrushed fibre	56.4
Yield of boiled unbleached (bone dry) fibre ..	17.7
Yield of boiled bleached (bone dry) fibre ..	13 1
Ash	2 08
Soda consumption (NaOH)	6 85
Bleach consumption (bleaching powder) .	2 03
Dry Stem—	
Yield of boiled unbleached fibre	31 4
,, ,, ,, (bone dry) fibre ..	25 0
Soda consumption (NaOH)	12 2
Bleach consumption (bleaching powder) ..	3 62
Ash of dry stem	3 70
Length of fibre (mean of 10 observations) ..	0 65mm.

From these trials it would appear that the ordinary type of boiler which is used for esparto would be suitable for Marram Grass also. Compared with esparto grass the fibres are shorter, but the paper appears to possess greater strength ; the consumption of soda is somewhat high in comparison, although in such a case, 80 to 90 per cent. of the soda would be recovered, and used over again. In fact, the Marram Grass paper had every appearance of possessing similar qualities to those of esparto. The yield was somewhat low, but the fibre possessed good felting qualities, and it appeared suitable for fine printings. The paper was harder in the unbleached state than the bleached.

Messrs. Clayton Beadle and Stevens remark that the paper-maker wants some assurance upon the subject of adequate supplies before he is disposed to try a material of this sort on an extensive scale, for he knows perfectly well that there are many fibres from which he could make paper provided they can be obtained in sufficient quantity to make the enterprise a financial success. The paper-maker therefore is naturally not disposed to exploit any particular material until he sees a chance of getting large and regular supplies of it at a low cost.

Marram Grass occurs on most of the sandy shores of the British coast-line. In some places it is limited to occasional

tufts, but as a rule it is distributed irregularly over a considerable area. Patches of from a few plants to stretches 20 or 30 yards across are found with moderately wide, bare intervals, the smaller patches being often buried to a considerable depth in loose sand. This would appear to make economical harvesting almost impossible and, if steps are to be taken to collect the material in bulk, certain areas should be set apart in Norfolk or Lincolnshire for experimental purposes. By selecting positions where the grass is already plentiful, and using the existing stock for close planting of an area of about five acres, it would be possible to harvest a full crop at the end of the second year which could be made the basis for deciding whether the crop is likely to be profitable or not. When growing in a dense mass it is unlikely that the leaves of any except those of the outer plants would become buried in sand and clean leaves would lessen materially the cost of harvesting. An area of five acres could be planted at a small cost, for the ground would need no preliminary preparation and two men would, in a few days, be able to divide up sufficient plants, and plant the area with clumps three feet apart.

Providing it proved to be a paying crop, marram grass might be planted on any sandy area along the coast. Suitable sites are to be found in Dorsetshire, Kent, Norfolk, Lincolnshire, Lancashire, South Wales, Scotland, and elsewhere.

The grass is said to be practically indestructible, burning, cutting, or eating-off by cattle making it thrive, and in most exposed shifting sands it grows as strongly as in a sheltered corner.

Regular plantations of Marram Grass have been grown in Victoria, Australia ; they are formed by dividing the clumps into sections as large as a man can conveniently grasp, and planting them two feet apart in rows six feet apart. Where the sand is not likely to shift, the roots are buried to a depth of nine inches, but where shifting sand is encountered they are buried from three to six inches deeper. In this way 3,630 plants are placed on an acre of ground, 2,800 plants weighing a ton. The most favourable time for planting (in Victoria) is from early May to the end of July, and at the end of a year thinning and transplanting are carried out if plants are required elsewhere.

Migration from Rural Districts in England and Wales.*

AT the request of the Dominions Royal Commission the Board have made enquiries with a view to ascertain to what extent migration is now, and has recently been, taking place from rural districts, more particularly by that part of the population which is engaged in agriculture.

A schedule of enquiry was sent in May last by the Board to the Board's Agricultural Correspondents, Crop Reporters, and Market Reporters; to Secretaries of Chambers of Agriculture and other bodies in association with the Central Chamber of Agriculture; and to Secretaries of a large number of co-operative and other bodies affiliated to the Agricultural Organisation Society.

The substance of the replies received has been published in a Report lately issued by the Board, the information being given under seventeen groups of counties, and relating in each case to—

1. Employment in agriculture and supply of agricultural labour;
2. The extent, cause, and direction of migration; and
3. Special instances of migration and general observations.

The prefatory remarks made in the Report, are as follows:—

It may be well to recall the general facts as to the movement of the rural population during the decade 1901-11, as shown by the recently published Census Report [Cd. 6258]. The decennial increase per cent. of the whole population was 10.89, being the lowest recorded in any decennium since the first Census in 1801. The rate of increase in 21 counties classed as "commercial and industrial" was 11.8 per cent., as compared with 13 4 per cent. in 1891-1901. On the other hand, in the 23 counties classed as "agricultural," the rate of increase was 6.2 per cent., as compared with 1.9 per cent. in the previous decennium. This rough generalisation would appear to show an improvement in 1901-11 over 1891-1901 as regards the rural population, but a full examination of the Census returns can be better undertaken when the "Occupation" tables are published.† The figures given suffice to recall the fact that the normal increase of population by excess of births over deaths must always be remembered. Agriculture in this country is not an expanding

* Report on Migration from Rural Districts in England and Wales. Price 3d.

† These tables for 1911 have since been published.

industry capable of absorbing the natural increase of population. On the contrary, the area of farmed land steadily declines. Since 1901 about 388,000 acres have been withdrawn from agriculture altogether, and about 1,060,000 acres have been withdrawn from arable cultivation. The levelling up of the general intelligence and education of farmers has led them to greater resourcefulness in the economy of labour and greater willingness to use labour-saving machinery and appliances. It might also be expected that the better education of the farm labourer would have made him individually more competent, but it may be doubted whether this factor counts for much in reducing the number of labourers employed. In fact, complaints are general that labourers skilled in their craft are less numerous than formerly. From the employers' point of view any sharpening of intelligence due to "literary" education does not compensate for lack of "technical" training

As against the economic conditions which make for decreased employment on the land, the only contrary influence at present is the increase of intensive cultivation—fruit-growing, vegetable-growing, flower-growing, and the like. Since 1901 the area returned as under small fruit has increased by about 9,000 acres. The area under vegetables and orchards has also extended considerably, and glass-cultivation has been developed on a large scale. Unfortunately we have no precise measure over a series of years of the increase of crops which involve the intensive employment on a large scale of manual labour, but it is clear that in this direction—apart from the multiplication of holdings cultivated by the occupier and his family—possibilities of employing more labour on the land at present mainly lie.

The concurrence of the natural increase of population with a reduced demand (except in a few limited districts) for labour on the land obviously implies chronic migration from the rural districts. It is difficult, under existing conditions, to regard as probable the employment in agriculture of a normal increase of, say, 10 per cent. each decennium, and the question is rather whether sufficient employment can be found to prevent in all districts an actual reduction of the agricultural population.

There is a general consensus of opinion in these reports, with very few exceptions, that the supply of labour is deficient. Some of the statements estimate the "deficiency" at very high percentages. It is clear that a definition of the term "deficiency" is wanted when statements of this kind are made. In many cases it may be surmised that reference is made to the number who might be employed if old conditions still existed, and not to the

actual number who could now find regular employment on the farms as at present cultivated. But when all deductions are made, it is evident that at the present time considerably more men could find employment on the land than are now available. There certainly appears to be a fairly general deficiency of skilled farm hands. The manual arts of agriculture are being neglected even by those who still seek employment on the land.

That there is a general movement of population from the rural districts these reports testify, but, as already pointed out, this is in some degree inevitable. It is not easy to estimate how far the movement is in excess of, or less than, the normal increase of population The impression given is that it has been much accelerated in the last year or two, but there is reason to doubt this. In some reports, indeed, it is stated that from various causes—the provision of small holdings being several times mentioned—there is, on the whole, less depletion of the rural districts in recent years than formerly. When the complete Census figures for 1911 come to be analysed, they may be expected to show that the reduction of the number of persons engaged in agriculture which was so prominent a feature of previous Censuses has been to some extent checked.*

The special peculiarity of the present "rural exodus" is that the normal movement to the towns and to industrial life—which has perhaps rather diminished than increased—is supplemented to so large an extent by a movement to the oversea Dominions. This accelerated emigration is attributed to several causes, the most generally mentioned being the activity of emigration agents in advertising the allurements of colonial life. They appeal to a generation which has become accustomed to the modern disregard of distance. Canada to-day seems as near to the young countryman as London did to his father. The freer life, the easy facilities for becoming a landowner, the wider scope for energy and enterprise, and the higher wages for manual labour are the prospects which appear to be the chief inducements to our rural population to emigrate. These prospects appeal especially to those who do not wish to leave the land but do not see in this country a reasonable chance of living by it. The low wages in the rural districts are mentioned as a cause of discontent, but it may be doubted whether this in itself is so powerful a factor as the lack of opportunity, and, in fact, there appears no evidence that emigration is greatest in districts where wages are lowest. More than once in these reports it is observed that many who

* See previous footnote

emigrate would prefer to stay at home if they could see a reasonable prospect of advancement in life. Better education, and, as is remarked by some, a kind of education which gives a distaste for country life, is referred to; while the desire for shorter hours of work, for free Sundays and for more holidays is also mentioned; but these are causes for leaving the country which are more likely to lead to migration to the towns than emigration to the colonies. The lack of housing accommodation is frequently mentioned as influencing men to leave the villages. It appears paradoxical that complaint should be made at the same time of dwindling population and insufficient cottages, but there can be no doubt that the question of rural housing is acute. In this connection, the competition of the townsmen has aggravated the situation, and allusion is made to the turning of cottages into "villas" and to the increasing tendency, fostered by bicycles, of urban workers to live in the rural districts.

Utility Poultry Club's Laying Competition.

IN the Utility Poultry Club's Laying Competition which is being conducted at Sedlescombe, under the management of Mr. J. N. Leigh, an endeavour is being made to test the egg production of similar strains of birds under different conditions of housing. Each competitor was required to enter eight pullets, four of which are located in small houses, and four in a large house similar in design to those used for intensive culture, but with ample grass runs attached, to which the birds have access.

The Small House Section is accommodated in a good grass field with a gentle slope and a southern aspect. In this field there are eight double houses, each capable of providing for two pens of eight pullets. The houses measure 12 ft. by 8 ft., they are 6 ft. 6 in. high in front, and 5 ft. high at the back, and are divided by a partition in the centre. The upper part of the front of each house is fitted with glass and canvas sliding shutters and a projecting weather board, while fixed glass windows, set in 9 inches from floor level at the front and at each side, afford excellent lighting when the birds are at work in the litter. The houses are slightly raised on wooden supports and the floors are of rammed earth.

The trap nests, which are operated most simply, and are proving very effective, are conveniently arranged so as to leave the floor space available for scratching; and the perches

are provided with dropping boards. Four grass runs measuring 12 yds. by 12 yds. adjoin each house, and two of these are available for the use of each pen.

In the second or Large House Section the birds are housed in one building, which measures 40 ft. by 20 ft., is 9 ft. high in front and 5 ft. 6 in. high at the back. The greater portion of the front is open, and sliding glass and canvas screens are available for regulating temperature and draught in accordance with the condition of the weather. Here, also, excellent lighting of the floor space is secured by glass windows set in the front and sides 9 in. above floor level. The trap nests along the front are suspended from above so that the floor space is left clear, while swinging wire netting screens cover the front, and rest on the top of the trap nests. At the back of the house there are five open partitions 8 ft. long where the perches are arranged lengthwise; no dropping boards are used, but a cement floor is laid down under the perches, while that in the rest of the house is of rammed earth. The space allotted to the heavy breeds is separated from that set aside for the light breeds by a partition A grass run of about an acre is available for the birds in this section.

In both the small houses and in the large house the utmost care has been taken to secure abundant light and air and to prevent the birds being subjected to draughts. In design the houses present many features which suggest very considerable experience and forethought.

Thirty-one entries were actually accepted for the competition, and they include :—

White Leghorn	.. ..	11	Pens (of eight pullets.)
Black ,,	.. ..	1	,,
White Wyandotte	..	11	,,
Buff Orpington	.. ..	2	,,
White Orpington	.. ..	2	,,
Buff Plymouth Rock	..	2	,,
Rhode Island Red	..	1	,,
Red Sussex	.. ..	1	,,
		31	

In each section 124 pullets are actually under test.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

FIELD CROPS.

Varieties of Potatoes (*Oxford Educ. Com.*).—The first set of experiments was carried out in 1913 at two centres, the heaviest yield at both being given by Abundance

In a second set, carried out on allotments on six different soils, Evergood gave on the average the best yields.

In school gardens on six different soils, Satisfaction and Epicure gave the highest average yields.

Varieties of Onions (*Oxford Educ. Com*).—The best results on a soil of stone brash resting on a limestone brash sub-soil were given by Ailsa Craig, Brown Globe, Early Gem, Long-keeping and Red Italian. On a sandy loam over a sandy sub-soil Long-keeping, Giant Rocca, Ailsa Craig and White Lisbon gave the best results Improved Queen (pickling variety) was a failure on both soils.

SOILS AND MANURING.

Soil Acidity and Liming (*Univ. of Wisconsin Agric Expt Sta., Bull. No.* 230).—This Bulletin deals with the relation of soil acidity to the following growth of legumes, available phosphates, supply of calcium, and weeds The beneficial effect of lime on acid soils is illustrated by the results of several experiments. The yields of lucerne hay, clover hay, and soy bean fodder were increased 43 3 per cent, 42 per cent, and 66 6 per cent., respectively, by the application of lime Methods for the detection of soil acidity and its causes are given, and the relative merits of several forms of lime are discussed

The Minimum Amount of Food necessary to ensure Maximum Plant Growth (*New York Agric Expt Sta., Bull* 360, *W. H Jordan*)—It is stated that the assumption that what a plant uses in growth represents its needs, and indicates what should be supplied either from the soil or in a manure, can hardly be considered sound It is well known that some plants, tobacco for instance, grow with equal luxuriance even when the ingredients of the ash differ in quantity and proportions to a marked degree. Further, the composition of the ash of the same species of plant varies greatly according to the locality in which the plant is grown and the methods used These experiments sought to ascertain, therefore, whether there is a determinable minimum proportion of certain ingredients in the dry matter produced by plants

In one set of boxes the plants were supplied with all the plant food necessary, except phosphoric acid, this being added in progressive quantities to the boxes. In another set of boxes all the plant food necessary was supplied except potash, which was also added in progressive quantities to the boxes.

The experimental plants included barley, peas, tomatoes, tobacco, buckwheat, rape, and turnips; their growth was, in most instances, such as would be satisfactory with field-grown crops, the production of dry matter with barley being, in two out of the three experiments conducted, beyond what could reasonably be expected in a farm crop

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Up to a somewhat indefinite point, the production of plant substance increased with the increase in the supply of the variable constituents, but beyond this point the utilisation of both phosphorous and potassium compounds increased without any consistent and well defined corresponding increase of plant growth.

The data secured did not permit the establishment of any definite minimum relation between the amount of phosphorous taken up by the plant and the dry matter produced.

The results obtained indicated, however, that what a given crop contains of certain elements is not necessarily to be regarded as a measure of what must be supplied to meet the needs for maximum growth.

Values of Certain Manures on Various Vegetable Crops (*Worcester County Exper. Garden, Droitwich, Ann. Report,* 1912).—Experiments were commenced in 1899 in order to test the values as a source of plant food of the following manures :—

1. Garden refuse (weeds, leaves, grass, burned stalks, sticks, prunings, etc) applied at the rate of 18 tons per acre.
2. Stable manure alone at the rate of 16 tons per acre.
3. Mixed inorganic fertilisers, used in proportions varying according to the kind of crop (superphosphate of lime, sulphate of ammonia, sulphate of soda, sulphate of iron, kainit)
4. The same fertilisers used supplementary to stable manure at the rate of 16 tons per acre.

In each case the manures were applied to the following vegetable crops : Peas, runner beans, broad beans, onions, parsnips, beet, potatoes.

The results of the experiments showed that decayed and burned garden refuse when used alone on the same ground for 14 years is a valuable plant food, giving results about equal to those obtained from stable manure alone. It was found that mixed inorganic fertilisers used alone gave inferior crops of all kinds except beet, but when used with stable manure the yield obtained was about equal to that obtained from stable manure alone

Further experiments were commenced in 1899 in order to test the relative values of kainit, superphosphate of lime, nitrate of soda and sulphate of ammonia. Each was applied alone to crops of peas, broad beans, runner beans, onions, parsnips and beet up to the end of 1908. In 1909 and subsequent years each inorganic fertiliser was used with the addition of 16 tons per acre of stable manure. The results showed that, with the exception of beet, the crops benefited greatly from the addition of stable manure to the fertiliser. The total crops of legumes during the four years from 1909 onwards exceeded the total of the same crops during the preceding seven or eight years The root crops, beet excepted, increased by about 40 per cent It was found that, of the four inorganic fertilisers, kainit gave the best results when used alone and also when applied with the addition of stable manure

LIVE STOCK AND FEEDING STUFFS.

Cattle-Feeding Experiments (*Edinburgh and E. of Scotland Coll. of Agric, Report XXXI ; W. Bruce, B.Sc.*).—The object of the experiments was to compare the feeding values of linseed cake, wheat bran, and a mixed ration of feeding stuffs compounded so as to contain approximately the same amount of food material as was present in an equal weight of the linseed cake used. In arranging the experi-

ments care was taken to provide not only for testing the possibility of compounding at less cost a complex ration that would be as efficient as a mixture of equal parts of Bombay cotton cake and linseed cake (a ration which has given very satisfactory results in previous feeding trials by the College), but also for equalising the amount of nutriment in the respective rations so as to make them comparable under the "Starch Equivalent" theory.

Forty-eight cattle were put into feeding-courts and supplied with turnips and straw and a small quantity of Bombay cotton cake till the 2nd December, when they were divided into 3 lots, and received during the following four weeks daily per head 98 lb. of yellow turnips and 10 lb. of oat straw along with concentrated food as follows —

Lot I.— 3 lb. Bombay cotton cake and 2 lb. linseed cake.
Lot II.— 3 lb. „ and 3 lb. bran.
Lot III.—5 lb. of a mixture consisting of—

Bombay cotton cake	2 parts
Bran	3 „
Linseed cake	1 part
Decorticated cotton cake	1 „
Maize meal	1 „

The allowance of concentrated food was gradually increased during the experimental period of 19 weeks which commenced on December 30th. Lots I. and III. began with 6 lb., and went up to 9 lb. per head per day. In the case of Lot II, owing to the less concentrated character of the bran, the allowance varied from 6½ to 11 lb. The average daily rations for the period of 19 weeks were approximately as follows :—

Lot I —3 95 lb. linseed cake, 3.78 lb Bombay cotton cake, 102 lb. swedes, 7.78 lb oat straw.

Lot II.—5 lb. medium bran, 3 78 lb Bombay cotton cake, 102 lb. swedes, 7 78 lb. oat straw.

Lot III —7 73 lb. complex mixture, 3 78 lb Bombay cotton cake, 102 lb. swedes, 7.78 lb oat straw

The lots made very nearly the same increase, the average daily gain per head being just over 2 lb. The cost of feeding per cwt of live weight increase was for Lot I., 43*s*. 4*d*.; Lot II., 40*s* 8½*d* , Lot III., 42*s*. 4*d*., while the prices realized per cwt. for the respective lots were 41*s*. 1*d*., 41*s*. 2*d*, and 41*s*.

The following table gives the financial results —

	Lot. I.	Lot II.	Lot III.
	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.
Weight at start, 16 "store" bullocks	131 0 0	131 3 20	131 2 21
Weight at finish, 16 "fat" bullocks	169 2 16	170 0 13	170 1 15
Total increase	*38 2 16*	*38 0 21*	*38 2 22*
	£ s. d.	£ s. d.	£ s. d.
Net cost of food consumed ..	83 10 11	77 14 8	79 6 4
Value at start at 37*s*. per cwt...	242 7 0	244 1 4	243 12 5
Value at finish at 40*s*. per cwt...	339 5 8	340 4 8	340 15 4
Difference being gross profit ..	13 7 9	18 8 8	17 16 7
Gain compared with Lot I...	—	*5 0 11*	*4 8 10*

The experimental figures indicate that when the consuming value of linseed cake is £6 15*s*. 6*d*. per ton, that of bran is £5 3*s*. 9*d*., and, therefore, when the respective manurial values are added, bran appears to be worth £6 10*s*. as compared with linseed cake at £8 6*s*. 9*d*. The figures also show that the complex mixture was more profitable than a mixture of equal parts of linseed cake and Bombay cotton cake to the extent of 12*s*. per ton.

First, Second and Third Years' Crops of Lucerne Hay for Milk Production (*Utah Agric. Expt Sta., Bull.* 126).—The experiment was carried out during two years. Fifteen cows were divided into three groups of five each, each group in both years going through three feeding periods in which respectively the three different crops of lucerne hay were tested The grain ration was fixed and the cows were allowed as much lucerne hay as they would consume.

On the whole the cows consumed somewhat more third crop than first, and more first than second crop hay. The cows produced slightly more butter fat while on first crop hay than while on either of the two other crops As regards butter fat produced per 100 " food units " consumed, the second crop hay was found to take first place, with first crop second and third crop last

This result was a contradiction of practical opinion in Utah which assigns greatest value to first crop hay , and it is explained that second crop hay may have proved more economical for butter fat production in this experiment because the cows relished it less, and, therefore, ate less of it. The hay used was from a light soil on a gravel sub-soil, and it is possible that hay from heavier soils would have given different results.

The Maintenance Requirements of Swine (*Univ. of Illinois Agric. Expt., Sta , Bull No* 163 *Abstract, W. Dietrich*).—Pigs differing in age, breed and conformation, were used in three successive experiments, including twenty-six separate maintenance periods, to determine the amounts of feed and of the respective nutrients required for maintenance. The rations were gradually reduced during several weeks' time until quantities were reached that maintained a constant live weight. The coefficients of digestibility of the various nutrients were determined in most instances. In one experiment the nitrogen balance and the consumption and excretion of water were also determined to show whether live weight was maintained by the substitution of water for body tissue.

The results of the experiments indicate that the maintenance requirements of pigs are variable, *i e.*, that any one pig under different conditions may maintain its live weight on distinctly different quantities of the same combination of foods. This variation seems to be due to the plane of nutrition upon which the pigs have been maintained previous to the time of making the maintenance experiment. The results also indicate that the maintenance requirement of pigs which previously have been kept on a low nutritive plane may be reduced to the following weights of nutrients per 100 lb. live weight . digestible crude protein, 0.10 lb. ; digestible carbohydrates, 0 25 to 0.40 lb. ; digestible ether extract, 0.03 lb.

Feeding Standards for Milk Production (*Cornell Univ. Agric. Expt. Sta., Bull.* 323 ; *E. S Savage*).—This Bulletin contains a brief review of the history of the science of animal nutrition. The feeding standards obtained by T. L. Haecker, at the Minnesota Agricultural Experiment Station as the result of work commenced in 1892 and those of H. P.

Armsby, of the Pennsylvania Agricultural Experiment Station, are given and discussed in the light of some feeding experiments carried out at Cornell on dairy cows in the winters of 1909-10 and 1910-11.

The writer suggests a feeding standard for milk production, which he bases on what has been learnt from practical experience together with the results of the two years' investigation at Cornell, but makes the proviso that any such standard can be used only as a guide, and must be departed from at times to suit the individuality of different animals or to meet existing conditions such as would preclude the use of high-protein foods

For maintenance, the writer suggests, per 100 lb , .0700 lb. protein and .7925 lb. total nutriment ; and for the production of 1 lb. of milk with varying fat contents, the following standards :—

Fat Content. per cent.	Protein. lb.	Total Nutriment. lb.
2.5	.0527	.2574
3 0	.0567	2870
3.5	.0608	.3185
4 0	.0648	3497
4 5	0689	3787
5 0	.0729	4048
5.5	0770	4311
6 0	.0810	.4572
6 5	.0851	4835
7.0	.0891	5075

Variation in the Physical Composition of Wheat Milling Offals. (*Journ. Agric. Science, Vol. VI., Part I., Jan.,* 1914 ; *Harold T. Cranfield*).—As the result of an investigation in which the author examined 100 samples of wheat offals, he found that their physical composition varied between very wide limits. The starch content of " Sharps " and " Bran " varied from 25 to 45 per cent , and from 10 to 20 per cent respectively It was found that these variations occurred not only in offals from different mills, but that any one mill sent out samples of widely different physical composition under the same name It is recommended that with a view to grading milling offals the following determinations should be made : percentage of moisture, apparent density, percentage of starch (or flour), and purity. A series of grades of offals should be arranged with stated limits for percentage of starch (or flour) and apparent density. There should be limits for all offals as regards percentage of moisture and purity, and instead of the local names, such names as " Fourths," " Thirds," " Seconds," " Bran," and " Broad Bran," should be substituted to designate the standard grades.

DAIRYING.

The First Lactation Yield as an Indication of a Cow's Milking Capability (*Jour. Agri Sci., Vol. V., Part VI., Oct.,* 1913; *W. Gavin, B.A.*).—From the point of view of the utilisation of milk records for the weeding-out of unprofitable cows it is important to know how far the first lactation yield may be taken as a guide to a cow's future milking capability.

The statistical investigations recorded were concerned with data for 336 cows which had had five or more calves (about 2,240 lactation

records in all). The "revised maximum" was used throughout as the measure expressing a cow's yield for any given lactation; it is defined as the maximum day-yield of the lactation which is three times reached (or exceeded).

The first lactation was found to show greater variability than the second, third, fourth or fifth

It was demonstrated that the estimation of one lactation from another cannot be made with great accuracy.

It is necessary, in classing a cow, to decide on one lactation that shall represent her mature capability. It is suggested that the maximum lactation is the most suitable one to choose

The correlation coefficient with the maximum lactation was found to increase from .394 for first to .762 for fifth lactation. The mean of the first and second lactations, however, gave a correlation coefficient of .526 with maximum lactation, which was higher than any of the first three taken separately

The probable error of estimating maximum from first, second, or third lactations was about 1.7 quarts. The mean of first and second lactations gave a probable error of estimate of 1.6 quarts.

Tables are given in the paper for estimating maximum lactation from both first lactation, and mean of first and second.

The general conclusion arrived at is, that with cows giving a fairly high or fairly low first lactation revised maximum, this figure should be used to determine whether they shall be kept or not, but with cows giving a medium first lactation revised maximum of 10–11 quarts it is worth waiting to obtain the increased accuracy of an estimate based on the mean of first and second lactation revised maximum.

The Effect of Pituitary Extract on the Secretion of Milk (*Quar. Jour Exp. Physiology, Vol. VI, No. 4; John Hammond*)—It is explained that the discovery of animal extracts acting on the mammary gland has provided a new method for the study of milk secretion. The object of these experiments, carried out at the Laboratory of the School of Agriculture, Cambridge, and aided by a grant from the Development Fund, was to investigate more especially the effect of pituitary extract on the mammary gland and to study the nature of the process whereby milk is secreted.

The experiments were performed on goats; in all, three animals were used in various known stages of lactation The injections of pituitary extract were 1 c c. of the extract of the posterior lobe injected subcutaneously over the neck or shoulder. These injections were always performed soon after the goat had been milked dry. The amount of milk secreted as a result of injection was ascertained by milking the animal half an hour after the injection was made The conclusions reached by the investigator are as follows.—

Injection of pituitary extract has an immediate action on milk secretion, but the effect soon passes off. During the period after injection there is a rather rapid decrease in the milk-flow, but this decrease is gradual and there is no sudden drop followed by increasing secretion to normal. From this and from the results of successive injections at various intervals as well as from numerous other observations it is concluded that the effect of the extract is not muscular.

The daily yield is only slightly increased as a result of injection. This shows that the extract acts rather by setting free than by causing the formation of the milk constituents.

From the composition of the milk obtained as a result of injection, together with other facts, it is concluded that the action of the pituitary extract is not effected through rise of blood-pressure.

The amount of milk secreted as a result of injection depends on the period of lactation and also on the state of nutrition. This, together with other considerations, supports the view that it is not variations in the condition of the pituitary gland which give rise to the cycle of changes which occur in the mammary gland.

Histological evidence points to a direct action of the extract on the glandular epithelium.

The milk obtained as a result of injection is normal in composition except for a higher percentage of fat; in the following milkings, however, there is a drop in the percentage of fat, although that of the other constituents remains normal.

While the amount of solids-not-fat secreted is in close connection with the water of the milk, the amount of fat secreted is in no wise connected with the amount of water. The ratio "nitrogen to lactose" is relatively constant throughout

These facts suggest the theory that the pituitary extract causes the combination of the precursor of milk-protein and lactose (possibly a glyco-protein) with water and salts of the blood, and so by a purely secretory action produces this part of the milk The suddenly altered tensions so set up in the epithelial cells cause the fat globules which have accumulated at the ends of the cells to be discharged and to produce milk which is rich in fat. It is because of the relatively large amount of the pituitary extract injected and because of the suddenness of the change that the fat percentage goes up. The act of milking, which also causes rapidly altered tensions, has the same effect.

Although there is considerable variation, yet the average results on varying the dose of pituitary extract injected show that the smaller doses give less milk with a lower percentage fat. When the doses are relatively large it does not matter how much is injected, for only a certain amount of milk can be obtained. There is some indication that a goat in the early stages of lactation is more sensitive to small doses than one in a later stage.

Experiments with fractional milkings show that while the percentage of fat rises from start to finish in normal milk, yet in milk obtained as a result of injection the percentage remains constant throughout

Effect of Concentrated Foods on the Quality of Butter (*Deut. Landw Presse, 3rd Jan.*, 1914).—This paper, quoting from the *Sächsische Landw Presse*, summarises the results of experience on this subject as follows.—

Crushed barley and barley meals influence the quality of butter favourably, as also do malt sprouts and brewers' grains if fed in a sound condition and in not too large quantities. Crushed oats give the butter a pleasing aromatic and nut-like taste, but if fed in excess they produce soft butter. Wheat bran produces a good butter, but more than 3½ lb per head per day makes the butter soft; it is best fed as a supplementary ration to foods such as cotton seed meal, sugar beet slices, and leguminous plants, which give a hard butter. Crushed rye and rye offals must only be fed to dairy cows in small quantities, as large amounts produce a coarse, dry butter. Crushed maize and maize offals form good foods for dairy cows, but large quantities result in a

soft and often oily butter. Crushed buckwheat and buckwheat offals are used, in general, for fattening purposes; the milk fat from this food is very difficult to make into butter, and the latter, when made, has a bad appearance.

Peas and beans give a white, firm butter with very little odour. Not more than 2¼ lb. per head per day should be fed to dairy cows, and even then along with foods producing a soft butter. It is asserted that vetches give a hard and bitter tasting butter. Cotton seed meal and cake should not be fed in quantities above 2¼ lb per head per day, the butter from large quantities of this food having a strong tallow-like taste and being very hard and white. Earth nut cake fed to the extent of 1 to 2¼ lb. per head per day gives the butter a fine aroma and a nut-like taste; too large quantities make the butter soft and cheesy.

Coconut cake is an excellent food for dairy cows and may be fed in quantity up to 4½ lb per head per day; it gives the butter a pleasant, nutty flavour, larger quantities give a hard, firm butter with a tallowy taste Small quantities of linseed cake give a good butter, which becomes hard and takes on a taste of linseed oil if more than 4½ lb. per head per day are fed to cows.

Palm nut cake and meal produce a butter of excellent consistency and good taste, from large quantities a hard butter is obtained From rape seed oil residues, if more than 2 lb. per head per day are fed, a butter is produced with an unpleasantly strong taste, a sharp smell, and a soft consistency, the butter often tastes fishy and oily and readily goes rancid Sesame cake fed alone and in large quantities gives a soft and oily butter, though with other foods and in quantities up to 2 lb. per head per day the quality of the butter is not impaired. The same may be said of sunflower seed cake

Meat meal, fed in quantities up to 2 lb per head per day, has no unfavourable effect on the taste of the butter, while butter from fish meal has a fish-oily taste.

Fresh and dried sugar beet slices in moderate quantities produce pale-coloured butter of good quality

HORTICULTURE.

Hop Investigations (*Oregon Agric. Coll. Expt Sta, Bull* 114)—Various manures were tried in some of the older hop gardens of Oregon, the results indicating that artificials are not profitable in the Willamette Valley, and that farmyard manure is best

All the methods examined for the quantitative determination of the total soft bitter resins and the hard resin in hops were found to be faulty with the exception of the modified Lintner volumetric method for the determination of total soft resins. New methods were devised which overcome the defects of existing methods.

An investigation was made into the effect of kiln-drying at 145° F. on the composition of the hop. There was found to be little change in the composition of hops when dried at this temperature.

The composition of the hop at different stages of ripeness was determined The results showed that during the ripening period there was a continuous increase in the amount of soft bitter resins, that there were no marked changes in the amounts of hard resin, wax, and tannin, and that there was no evidence that one constituent changes over to the form of another.

FUNGUS PESTS.

Finger-and-Toe Disease in Brussels Sprouts (*Worcester County Exper. Garden, Droitwich, Ann. Report,* 1912).—Experiments in destroying this disease were commenced in 1903, the pest having become so strongly established that it was impossible to grow Brussels sprouts on the land.

Gas lime and quick lime were used for five years, the percentage of clean-rooted plants at the end of that time being as follows : Gas lime 2.38, quick lime dug in 52.38, and quick lime left on the surface 64.28. By 1911, the plots treated with quick lime dug in and left on the surface each yielded 97.82 per cent. of clean-rooted plants. Gas lime was no longer available and apterite and vaporite were tried instead, but without result. A further trial showed that a surface dressing of quick lime gave much better results than iron sulphate.

"Grey Leaf" or "Dry Leaf" on Oats (*Edinburgh and E of Scot. Coll. of Agric., Report XXX.*) —This disease, which is common on oats, has appeared each year on the trial plots at the College. The symptoms observed on the plots agree with those recorded in Holland, Sweden, and Denmark

When the first shoot begins to elongate the lower leaves lose colour and vigour. The damage spreads rapidly upwards. Sometimes the upper leaves retain a healthy appearance, but on other plants they are conspicuously marked with red stripes The ears may be quite absent or late in emerging and small. There is generally a number of white dead spikelets with no grain.

Grey leaf appears to attack certain varieties of oats It has been suggested that the disease is favoured by manures which produce an alkaline soil (nitrate of soda, and basic slag), and it is less likely to occur after the application of such acid manures as sulphate of ammonia and superphosphate ; sulphate of manganese also promotes healthy growth.

POULTRY.

Utility Poultry Club's Twelve Months' Laying Competition.—Three months' work has been completed in the 1913-14 laying competition of the Utility Poultry Club at the Harper-Adams Agricultural College, Newport, Salop. Fifty pens of six pullets each are competing. The following table shows the positions and scores of the leading pens :—

Order.	No. of Pen.	Breed.	Total Eggs for Three Months.	Value.		
				£	s.	d.
1	18	White Wyandottes ..	362	2	16	1¼
2	6	,, ,, .	329	2	12	3½
3	46	White Leghorns.. ..	296	2	7	3¾
4	39	,, ,, ..	303	2	5	8¾
5	2	White Wyandottes .	255	2	2	0
6	3	,, ,, .	255	2	0	11¼

NOTES ON AGRICULTURAL CO-OPERATION.

Newcastle, Gateshead, and District Butchers' Cattle Insurance Society.

THIS society was founded in 1892 with the object of compensating members "losing cattle, seized or surrendered, and destroyed, affected with tuberculosis, or other disease, or by accident." It is confined to members of the Butchers' Association, and was registered on 4th May, 1900, as a Cattle Insurance Society under the Friendly Societies Act.

The great majority of the Cattle Insurance Societies in this country, generally known as "Cow Clubs," are formed by the owners of cows with the object of compensating those members whose cows may die or have to be slaughtered in consequence of disease or accident. The object of this Newcastle Society is quite different, practically it insures butchers against the risk of having cattle, which they have purchased for sale as beef, condemned by the Sanitary Authority as being unfit for human food.

All members are required to insure week by week all the cattle purchased by them during the year. Originally the rule was that the society would pay two-thirds of the value of a condemned animal, "together with such offal as allowed," but some years ago an arrangement was made with the sellers of cattle in the market under which, in lieu of a warranty, the sellers agreed to pay to the society *6d.* per animal sold; and since that arrangement was made, the society pays as compensation the full value of the condemned animal, while any sum realised on the hide and fat is credited to the society's funds.

The system on which the society works is to classify animals, purchased for slaughter, according to the estimated risk of condemnation of each class: each such class of animal pays its own rate of premium and has its own separate account, which is made up for each class separately at the end of the year. Should there be a surplus, it is distributed by way of a dividend to the butchers who have paid premiums on that class of animal during the year; while, should there be a deficiency in the class, it is made up by a levy on the butchers who have paid premiums on that class in proportion to the number of animals insured. This system has been in force during the last three years, and it is instructive to study the average experience of those years class by class.

In 1910 there was a class for cows, on which the premium charged was *7s. 6d* a head, the premiums amounting to £59, and the number of animals insured to 156½ (the fractions are due to its being permissible to insure one half or one quarter of a risk): the claims paid were for 14¾ cows and the amount paid was £255, so that the rate of condemnation was over 9 per cent., the average value of the condemned cows was £17, and the actual cost of the compensation paid was £1 *13s. od.* per cow insured. It was therefore found necessary to make a levy on all cows insured of £1 *os. 10d.* per head to clear the liabilities of that particular class, and the society considered the results so unsatisfactory that it decided to cease the insurance of cows altogether. The classes now adopted, with the rates of premium charged, are as follows:—

	Per animal. s.	d.
Bullock or Maiden Heifer	1	6
Heifer that has borne one calf (Class II.)	3	0
Bulls—Class I. (with less than 4 adult teeth)	2	6
Bulls—Class II. (with four adult teeth and over)	5	0

On the average of the last three years the number of animals annually insured has been as follows :—

Bullocks and Maiden Heifers	14,596
Heifers—Class II.	120
Bulls—Class I.	206
Bulls—Class II.	239
Cows	52
Total	15,213

so that the class of Bullocks and Maiden Heifers is by far the most important.

For the last three years the average annual income of the society has been as follows :—

Premiums	£1,200
Levies	52
Hide, Tallow, &c.	156
Interest	2
Sundries	35
Total	£1,445

and the average annual expenditure has been :—

Claims paid	£1,005
Dividends	224
Salaries	47
Other Expenses	30
Total	£1,306

so that the working of the society for these three years shows an average profit of nearly £139 per annum, and the balance to the credit of the society at the end of the year has increased during the three years from £15 to £430 The income from the hide and tallow of the condemned animals more than covers all the expenses of management, so that the whole income from premiums and levies is available to meet the cost of compensation and dividends.

If now the class of bullocks and maiden heifers be considered by itself, the average number of animals insured annually during the last three years has been 14,596, on which, at the rate of 1*s*. 6*d*. per head, the premiums received averaged £1,095 : the number of animals of this class on which compensation was paid averaged 46, and the amount of compensation paid averaged £787, so that the average condemnation rate of this class of animal was only 3 per thousand, the amount paid per claim was £17, and the total sum paid on claims equalled 1*s*. 1*d*. per animal insured. Accordingly a dividend was returned to the members insuring this class of animal in each of the three years at the rates respectively of 3*d*., 8*d*., and 5*d*. per head, the average rate of dividend being about 5*d*.; so that the net premium paid by the members

insuring in this class averaged 1*s*. 1*d*. per head, and to judge by the experience of the last three years, it would seem that a premium at this rate of 1*s*. 1*d*. per head would be sufficient to cover the average losses.

The experience as regards Heifers—Class II., that is, heifers which have borne one calf, is as follows on the average of the last three years. The number annually insured was 120; the premium received at the rate of 3*s*. per head amounted to £18; the number of claims paid averaged 6⅔, which gives a condemnation rate of 5.6 per cent.; the amount of compensation paid was £102 per annum, an average of £15 per heifer condemned, and of 17*s*. per animal insured. Accordingly in each year it became necessary to make a levy on the members insuring this class of animal at the following rates in the different years, viz: 6*s*., 12*s*. 4*d*., and £1 1*s*. 9*d*., or an average levy of 13*s*. 4*d*., so that for the insurance of heifers of this class members actually paid an average premium, plus levy, of 16*s*. 4*d*. per head.

For Bulls—Class I. (that is with less than four adult teeth) the rate of premium charged is 2s 6d. per head, the average number of animals insured being 205, so that the receipts from premiums averaged £26; the number of claims averaged only two-thirds of an animal per annum, a condemnation rate of 3 per thousand. The average amount paid on claims was £9, which gives an average of £14 paid per animal and of 11*d*. per animal insured. Accordingly, in this class in the last two years, a dividend of 1*s*. 6*d*. per head was returned to the insuring members, and the net premium paid during the three years has been only 1*s*. 6*d* per head

For Bulls—Class II. (that is, with four adult teeth and over) the rate of premium is 5*s*. per animal; the average number of animals insured was 239, the amount of premium received £60, the average claims 1 $\frac{1}{12}$, and the amount paid £22, which gives an average of £20 per animal condemned, and of 1*s*. 10*d*. per animal insured. Accordingly, in the last two years dividends of 4*s* and 2*s* per head have been returned to the insuring members of this class of animal and the net premium paid by members has been only 3*s*. per animal

The above results may be put together as follows, as showing the experience of the Newcastle butchers in the matter of condemnation for sanitary reasons of animals purchased by them for slaughter —

Class.	Condemnation rate per cent.	Amount of Compensation paid per Animal condemned.	Amount of Compensation paid per Animal insured.
		£	£ s. d.
Bullocks and Maiden Heifers	0.3	17	0 1 1
Heifers that have borne one calf, Class II.	5.6	15	0 17 0
Bulls with less than four adult teeth, Class I.	0.3	14	0 0 11
Bulls with four adult teeth and over, Class II. ..	0.45	20	0 1 10
Cows	9.0	17	1 13 0

If this experience were considered enough to go upon, and the society were to decide to revise its rates in accordance with it and to

provide for the gradual building up of a Reserve Fund, the following rates would seem to be sufficient for the purpose :—

	£	s.	d.
Bullocks and Maiden Heifers	£0	1	3
Heifers—Class II.	1	0	0
Bulls—Class I.	0	1	3
Bulls—Class II.	0	2	0
Cows	2	0	0

With these rates it should seldom be necessary to make a levy and any dividends would probably be small; and if the society agreed to forgo dividends and to carry savings to a Reserve Fund, it might expect to accumulate a substantial reserve, from which any deficiency in any particular year could be made up; it might thus expect soon to attain the position of being free from the necessity of making levies, and possibly of being able in time to make a reduction in the rates of premium charged, according to the further experience gained

It is interesting to note how very small is the risk of condemnation for sanitary reasons of a bullock, maiden heifer or young bull, and how enormously that risk is increased by the fact of a heifer having borne a calf. This affords some reason to believe that if the system of insuring cows and female calves, to which so far in this country co-operative insurance among the owners of cattle has been confined, were extended to male animals, co-operative cattle insurance societies would find it possible to insure them against disease or accident at a much lower rate than the 5*s*. per annum, which is found by experience to be more than sufficient to cover the risk for female animals.

Winslow Shire Horse Society.

THIS Society was established at Winslow in Buckinghamshire in 1886, "for the purpose of providing a Stud Cart Horse of the Shire Breed for the use of the members." The rules lay down that the funds of the Society shall be provided by a limited number of members, who are to subscribe £5 each, but so far only £2 10*s*. has been called up from each member The business of the Society is managed by a Committee of twelve, to whom all applications for membership have to be submitted for approval and who have the entire management of the horse. The fee for each mare is fixed annually by the Committee with regard to the probable expenses to be met. All fees become due on the 1st August and are to be collected by the Committee immediately after that date Any member desiring to withdraw his subscription must intimate his desire to the Committee, who have power to deal with it; so far the Committee have returned the deposit of £2 10*s*. to each member who has expressed a wish to retire.

During the last six years the number of members has increased from 112 to 126, each of whom has made himself liable for £5, and has paid up £2 10*s*., which may be described as called-up capital, amounting in all to £315. During the first three of those years the Society hired only one stallion per season at a rate varying from £210 to £315, but in the last three years it hired two stallions per season, one of them a better class of animal than the other. During the last two of these seasons the better horse was "Halstead Blue Blood," hired at a fee of £525, and the nomination fee charged for his services was £8 8*s*. in 1911, when his services were restricted to 60 mares, and £5 5*s*. in

1912, when he was allowed to serve 100 mares. In both years the fee for the less expensive horse was £3 3*s*., and the hiring fee paid for him by the Society was in one year £315 and in the other £250. On the average of the six years the amount paid by the Society for the hire of a stallion was £324, and the amount earned by the Society in nomination fees was £358 per stallion, so that the nomination fees more than covered the amount paid for the hire.

Putting together the accounts for the six years the income has averaged as follows:—

Nomination Fees	£545
New Members' Deposits	10
Allowance for Forage	30
Interest	9
Donations and Honorary Subscriptions	62
Foal Show Receipts	22
Total	£678

and the expenditure has averaged as follows:—

Hire of Stallion	£486
Forage, Stabling, &c.	28
Deputation Expenses	3
Foal Show Expenses	72
Other Management Expenses (including £5 5*s*. paid to the Secretary)	27
Sundry Expenditure	37
Total	£653

thus showing an average net profit of £25 a year.

The Balance Sheet for the year 1912 shows as assets:—

Cash at the Bank	£579
Unpaid Fees and Donations	127
Total Assets	£706

Against this the only liabilities are £10 paid in advance for the Foal Show and £315 due to members for deposits, thus leaving a net surplus of assets over liabilities of £381, an increase of about £150 over the corresponding figure of six years ago The Society therefore appears to be in a sound financial position.

If the receipts and expenditure on account of the Foal Show be deducted and the donations be considered as given for the Foal Show, and the new members' deposits be reckoned as capital, the account stands as follows:—

Average Income:

Nomination Fees	£545
Allowance for Forage	30
Interest	9
Total	£584

Average Expenditure:

Hire of Stallion	£486
Forage, Stabling, &c.	28
Deputation Expenses	3
Other Management Expenses	27
Sundry Expenditure (deducting fees in arrear)	7
Total	£551

so that, apart from the Foal Show, the Society is more than self-supporting.

The Society now generally arranges to hire two horses, one over four years old to serve 100 mares, and one a three-year-old to serve 60 mares. The service fee for one horse is fixed at £3 3s., and that for the other at such a rate as will bring in an income large enough to cover the hiring-fee and pay working expenses, as no separate subscription for costs of management is levied from members. The quality of the stallions engaged has been steadily improving and the hiring fee paid rising Last season (1913) the Society hired two horses at 675 guineas to serve 160 mares and for this season (1914) it has hired two horses, " Halstead Blue Blood " and " Blaisdon Jupiter," at 800 guineas, to serve 200 mares. The number of nominations allowed is always fully taken up, and the number of mares served has averaged 89 per stallion for the last six seasons. It is estimated that 65 per cent of the mares served drop a foal. The stallion-owner pays the Society 25 guineas for stabling and forage for each horse, and the Society pays generally 4s. a night to the farmer who puts the horse up. The groom in attendance on the horse pays his own expenses The season lasts from 23rd March to 29th June The owner undertakes, in the event of a stallion becoming incapacitated during the travelling season, to provide as a substitute the best possible horse he can send which may be at liberty at the time

The Society's operations are reported to have led to a marked improvement in the quality of the Shire horses bred in the neighbourhood, and to a substantial increase in the prices obtained by members for their foals

The following are the rules of the Society —

1.—That the Funds of the Society shall be provided by a limited number of Subscribers of £5 each.

2 —That every Subscriber of £5 shall be a Member of the Society, and entitled to the use of the Horses at the fees fixed by the Committee, according to Rule 9

3.—That the business of the Society shall be managed by a Committee of Twelve Members. Four to retire annually by rotation and to be eligible for re-election. Three to be the quorum for the transaction of business

4.—That all applications for Membership shall be submitted to a meeting of the Committee ; a majority of those present shall decide whether the application be accepted.

5.—That the Committee shall have entire management of the Horses.

6.—That if the management of the Committee be considered unsatisfactory, the Chairman shall, on requisition in writing by Five Members, call a special meeting of the Members to consider any complaints.

7 —That a General Meeting of the Members shall be held in the month of January in every year, or at any other date the Committee may direct, for the presentation of the accounts of the Society, the election of Officers and New Members, and of Four New Members of the Committee for the ensuing year

8.—That the Accounts shall be audited by two Members (not on the Committee) previous to the General Meeting.

9.—That the Fee for each Mare shall be fixed annually by the Committee, having regard to the probable expenses to be met.

10.—That all Fees shall become due on the 1st August, and shall be collected by the Committee immediately after that date.

11.—That any Member in arrear with his payments on the 1st of January in any year shall, at the discretion of the Committee, cease to be a Member, and forfeit his Subscription.

12.—That any Member desiring to withdraw his subscription must intimate his desire to the Committee, who shall have power to deal with the same.

Agricultural Co-operative Credit Societies and Joint Stock Banks.

IN this *Journal* for February, 1913, an article was published giving an account of the arrangements which had been made by the Board of Agriculture and Fisheries with a number of Joint Stock Banks in regard to the assistance to be given by the Banks to registered Agricultural Credit Societies, consisting mainly of small holders and allotment holders.

The following 22 Banks have agreed to offer the facilities described in that article to approved Co-operative Credit Societies:—

1. Bank of Liverpool
2. Barclay and Co.
3. Beckett and Co
4. Capital and Counties Bank.
5. Co-operative Wholesale Society, Ltd, Manchester.
6. Farrows Bank, Ltd.
7. Fox, Fowler and Co., Wellington, Somerset.
8. Lincoln and Lindsey Banking Co.
9. Lloyds Bank.
10. London County and Westminster Bank.
11. London and Provincial Bank
12. London and South-Western Bank.
13. Manchester and Liverpool District Banking Co
14. Metropolitan Bank of England and Wales, Birmingham.
15. National Provincial Bank of England.
16. Nottingham and Notts Banking Co.
17. Parr's Bank
18. Union Bank of Manchester.
19. United Counties Bank.
20. Union of London and Smiths Bank.
21. Williams Deacon's Bank.
22. Wilts and Dorset Banking Co.

Model Rules for a Pig Insurance Society.

THE Board have issued a set of Model Rules for a rural co-operative pig insurance society registered under the Friendly Societies Act, 1896, which they hope will prove useful not only to pig owners contemplating the formation of such a society, but also to clubs which are already in existence.

The rules in question have been divided into two parts, the more important rules from the point of view of the ordinary member being contained in Part I., which deals principally with

membership, contributions, marking of pigs for insurance, inspection of diseased or injured pigs, valuation, benefits and liability of society, liability of members, insurance fund, and management fund. Part II. deals with such subjects as the general meetings, the committee and officers, the application and investment of funds, penalties and fines, and inspection and audit.

Similar model rules have also been issued for Pig Clubs which may not desire to register themselves under the Act

Either set of rules may be obtained from Messrs. Wyman & Sons, Ltd., 29, Bream's Buildings, Fetter Lane, E C., price 1*d*.

The Co-operative Sale of Honey.

The formation of societies for the co-operative disposal of honey is advocated in an article in the *Deutsche Landwirtschaftliche Genossenschaftspresse*, especially in cases where the bee-keepers cannot sell their honey privately at remunerative prices A society which was formed in the district of Manderfeld, in Germany, is cited as an example Before the formation of the society the prices realised for honey were not remunerative, but the result from co-operation has been to double the prices, and all honey produced by the members is now disposed of through the society The society numbers 183 members, and has now been at work for ten years, its reserve fund has reached £150; its capital is £200

In this district the honey is made by the bees chiefly from heather, there being very few other plants as sources of honey, and it was formerly very difficult for individual bee-keepers to extract this heather honey from the combs. Effective apparatus for the purpose has been purchased by the society, and the combs with honey are bought by the society from the members at about 6*d*. per lb, any surplus profits after the working expenses and contribution to the reserve fund have been met being distributed among the members in proportion to the honey supplied by each.

The society has its own building, in which the members' honey is extracted and prepared for market The building contains two large rooms; one is the extracting room, while the other serves as a store room for the prepared honey until it is sent to market The cost of the building was about £140.

OFFICIAL NOTICES AND CIRCULARS.

Census of Agricultural Production.

The Board of Agriculture and Fisheries are engaged in collecting information in connection with the Census of Production, which is now again being taken, for the compilation of another Report on the Agricultural Output of the country, similar to that issued for the year 1908 A large number of forms of enquiry on various points have been sent to occupiers of land who will, it is hoped, as on the previous occasion, assist the Board by furnishing the information required The particulars asked for are solely for use in the Statistical Division of the Board for this purpose.

The Board have published, as No. 18 of their series of Miscellaneous Publications, a Pamphlet on "The Cultivation of Osiers and Willows."

The Cultivation of Osiers and Willows.

It seems probable that willow-growing is a sufficiently profitable industry to justify an extension in the area devoted to it in this country, though it must be borne in mind that willows and osiers require moderately good agricultural land for their successful growth, while, in addition, the question of marketing needs to be considered.

Basket-making, especially for agricultural purposes, might in some cases be carried on as a local industry where the willows are produced, and in this way the cost of carriage of the raw material would be saved. Several County Councils at present provide instruction in basket-making, and at such centres the question of willow-growing might be considered.

The Board are indebted to Mr. Paulgrave Ellmore, of Leicester, for the bulk of the information in this Pamphlet.

The Pamphlet may be obtained at the Office of the Board of Agriculture and Fisheries, 4, Whitehall Place, S.W., price 2d., post free. Letters of application need not be stamped.

Foot-and-Mouth Disease in Ireland.

The Board of Agriculture and Fisheries received information on January 31st that an outbreak of Foot-and-Mouth Disease had been confirmed near Naas, County Kildare, Ireland, by the Department of Agriculture and Technical Instruction for Ireland; further, that the Irish Department were scheduling an area of approximately 15 miles radius round the infected farm and would proceed with the slaughter of the animals thereon As a preliminary measure that Department had also instructed their Port Inspectors to allow no shipments of animals to Great Britain until further notice

After considering the position the Board decided that the circumstances would warrant permission being given for the landing of animals for slaughter within the landing place from all ports in Ireland other than Dublin, from which port no shipments of animals could with safety be allowed, owing to the proximity of Dublin to the disease centre, and the trend of the trade from Kildare. An Order to this effect was issued, and arrangements were at the same time set on foot for tracing to their destination in Great Britain all animals that had been shipped to Great Britain from Dublin within the fourteen days preceding January 31st As regards any such animals that remained alive, notices prohibiting their movement, or that of other animals with which they had been in contact, from the premises were at once served on the owners of the animals, and Local Authorities were asked to arrange for the veterinary inspection of such animals at the earliest possible date.

Any stockowners who had in their possession animals recently landed from Ireland were advised to take steps to secure their immediate isolation and to notify the fact to the Local Authority concerned.

The Board detained at the landing places all animals that had been shipped previous to the prohibition, but have since allowed the removal under certain conditions of those animals that were not shipped at Dublin and did not come from counties adjoining that in which the outbreaks occurred. The Board on the 6th February allowed the landing for slaughter of animals shipped at Dublin.

Potatoes suitable for Planting on Infected Premises.—The Board of Agriculture and Fisheries desire to remind all occupiers of premises declared infected for the purpose of the Wart Disease of Potatoes Order that it is illegal to plant any potatoes on such premises unless a licence has previously been obtained from an Inspector of the Board or of the Local Authority. The penalty for any contravention of the Order is a fine not exceeding Ten Pounds

Wart Disease of Potatoes Order, 1914.

Such licences can, however, as a rule be obtained on application to the Board by any occupier who undertakes to obtain from a reliable dealer one or more of the varieties of potato referred to below, all of which have been tested, some of them for several years, and have been found to resist Wart Disease under ordinary circumstances.

Should any occupier have any difficulty in finding a potato dealer who can supply the variety he wants, the Board will, on application, send a list of dealers who have undertaken to stock these potatoes, with a statement as to the varieties which each is able to offer.

Milecross Early—White, round, not liable to ordinary potato disease (*Phytophthora*), matures rapidly, haulm strong, and quality good.

Conquest—White, round, heavy cropping, second-early potato of good quality; must be earthed up high, as tubers are produced near surface

Jeanie Deans—A fine oval potato with strong haulm and white flower Crops heavily on light, rich soils Stocks of this variety are not large

Dobbie's Favourite—A second-early, round in shape, white flower, an excellent potato when well grown

Abundance—A well-known heavy cropping, late variety, oval in shape, of good quality, rather liable to ordinary disease, white flower

Sutton's Supreme—A second-early of pebble shape, white flower, suited to garden cultivation

Great Scot—A very good second-early, white and round, eyes rather deep; haulm robust, a very heavy cropper under good cultivation. Quality excellent, flower, white

Schoolmaster.—A second-early, white-skinned and round, crops well, but is liable to ordinary disease Not a good keeper

Crofter.—A late oval potato of good quality; liable to ordinary disease. Flower, white

Culdees Castle—A pebble-shaped variety, not quite so strong in the haulm as Crofter, and liable to produce more seed size tubers on light soil. Does well under garden cultivation Flower, white

White City—A late, kidney-shaped variety A fine potato for garden cultivation, but not a heavy cropper Under high cultivation tubers are frequently hollow Of first rate quality. Flower, lilac.

Provost.—A late, white round potato possessing strong haulm and white flowers; well suited to garden cultivation. "Seed" should be changed every second year.

The Admiral—A late variety, white-skinned and round. Haulm medium, a heavy cropper and good disease resister. Quality excellent. Flower, white.

Irish Queen.—Tubers round, eyes rather deep, haulm strong. Excellent cropper Keeps late into season

St. Malo Kidney.—Tubers coarse, kidney-shaped Haulm robust. Not a good keeping variety.

King George V.—An elongated oval tuber, skin netted, eyes shallow, haulm strong. An excellent cropper. Quality moderate.

Davie's Laird.—Roundish tuber, flesh white. A robust variety that crops heavily on well-prepared medium loams. Quality excellent.

Flourball.—Well-known late variety, round and pink-skinned. Eyes rather deep, haulm straggling with bronzing on stems when exposed. Quality very good ; flower, white.

Golden Wonder.—A late white-fleshed kidney with yellowish brown tinge on skin. The " seed " should be a good size and if unsprouted should be planted before the end of March, as the variety requires a long growing season. Liberal manuring is essential, and in gardens bastard trenching is recommended. It is possessed of excellent quality, and is one of the best late keeping potatoes. Flour, mauve-tipped white

Peacemaker.—Is similar to Golden Wonder.

Langworthy—A late kidney-shaped potato possessing white skin and flesh. Tubers that are fully developed may generally be recognised by the characterisitc tapering " heel." Quality excellent. Same treatment required as for Golden Wonder. Flower, mauve-tipped white.

What's Wanted.—Shape not so constant as in Langworthy. In other respects very similar.

N.B—The four last-mentioned varieties are, relatively speaking, light croppers, but they are probably unsurpassed as resisters of ordinary potato disease

This list is not exhaustive, and there are several other varieties which are resistant. They are not quoted as the supply of potatoes of " seed " size is believed to be small.

The Wart Disease of Potatoes Order of 1914.

The Wart Disease of Potatoes Order of 1914 of the Board of Agriculture and Fisheries, which came into operation on February 3rd, 1914, makes the following (among other) provisions :—

Notification of Disease—The occupier of any premises on which Wart Disease exists, or appears to exist, shall forthwith notify the fact by post or otherwise to the Board, or to an Inspector or other officer of the Board or of the Local Authority authorised to receive such notification, and where practicable a specimen showing the disease shall accompany the notice

Precaution to be adopted in case of an Outbreak or Supposed Outbreak of Disease—No tubers shall be removed from any premises on which Wart Disease exists or appears to exist until after the investigation required by the next Article

Investigation by Local Authority—(1.) The Local Authority on receiving in any manner notice of the existence or apparent existence of Wart Disease shall forthwith take such steps as may be necessary to determine on what premises the disease exists in the crops or soil, and shall cause notice of such determination to be served on the occupier of each of such premises, which, within the limits specified in the notice, shall thereupon become " infected premises " and continue to be infected premises until the notice is withdrawn, but the limits of the infected premises may be extended by a notice served by the Local Authority on the occupier of the infected premises.

(2.) The notice shall as far as practicable include in the infected premises only those lands in which there are or have been diseased tubers.

Action to be taken after Preliminary Investigation.—(1.) The Local Authority may at any time and from time to time by a notice served on an occupier of infected premises require him to adopt such measures

for prevention of the spread of the disease as are authorised by this Article and specified in the notice.

(2.) A notice under this Article may require the occupier of the premises to adopt any one or more of the following measures :—

(a) to destroy any part of the crop, except the tubers, by fire or such other suitable method as may be specified in the notice ;

(b) to boil thoroughly all diseased tubers ,

(c) to take such other steps as the Local Authority may consider necessary to prevent the disease being conveyed to other premises

(3.) Nothing in this Order shall prevent the destruction by the owner thereof, by fire or other effective method, of any diseased tubers

(4.) A notice under this Article may prescribe the time within which the adoption of any measure thereby prescribed shall be completed

Power to Prohibit the Planting of Potatoes on Infected and other Premises —The Local Authority may, by a notice served on the occupier of any infected premises or any adjoining premises to which the disease is likely to spread, prohibit the planting of potatoes in the infected or other premises except under such conditions as may be prescribed in the notice.

Provisions to prevent Spread of Disease by Planting Diseased Potatoes. —(1.) Diseased tubers shall not be used for planting or sold or offered for sale for any purpose

(2.) No person shall use, except by licence of an Inspector of the Board or the Local Authority, or sell or offer for sale for planting tubers which to his knowledge have been grown on infected premises, whether the premises have been declared to be infected before or after the tubers were lifted

(3.) An Inspector of the Local Authority, acting under their directions, may by a notice served on any person having in his possession or under his charge tubers which are diseased, or in a pit, bag or other receptacle with diseased tubers, or which the Inspector has reason to believe to have been in a pit, bag or other receptacle with diseased tubers, or otherwise exposed to infection with disease, prohibit the removal of the tubers from the premises on which they are when the notice is served, except under such conditions as the Inspector, acting under such directions, may consider necessary to prevent the spread of disease and prescribe by the notice

Withdrawal of Notices of Infected Premises —A notice constituting any premises infected premises may be withdrawn by a notice signed by an Inspector or other officer of the Board Unless there are special circumstances, a notice of withdrawal shall not be issued as regards any premises until the expiration of three years from the date of the notice declaring the premises infected.

Information to be given as to Diseased Potatoes —Every person who has or has had in his possession or under his charge any diseased tubers, and every person who as auctioneer, salesman or otherwise has sold or offered for sale any such tubers shall, if so required in writing by the Board, or the Local Authority, or an Inspector of the Board or of the Local Authority, give the Board, or the Local Authority, or the Inspector as the case may be, all such information as he possesses as to the persons in whose possession or under whose charge they are or have been Provided that any information given under this Article shall not be available as evidence against the person giving the same in any prosecution under this Order, except in respect of an alleged failure to comply with this Article.

Powers of Entry.—Any Inspector or other officer appointed in that behalf by the Local Authority, upon production if so required of his appointment or authority, may for the purpose of enforcing this Order enter any premises and examine any plant or tubers thereon.

The Wart Disease of Potatoes (Infected Areas) Order of 1914.

The following are the chief provisions of the Wart Disease of Potatoes (Infected Areas) Order of 1914 of the Board of Agriculture and Fisheries, which was issued on February 2nd, 1914:—

Restriction on Planting in Infected Area.—No potatoes shall be planted in an area declared by the Board to be infected with Wart Disease, except with the authority of a licence granted by an Inspector of the Board or otherwise than in accordance with the conditions imposed by the licence. The licence may prescribe the variety of potatoes authorised to be planted, and the source from which the potatoes shall be obtained.

Restriction of Removal of Potatoes grown in Infected Area.—Potatoes grown in an infected area, whether before or after the declaration of the area to be infected, shall not be removed from the infected area, except with the authority of a licence granted by an Inspector of the Board: provided that this restriction shall not apply to the removal of potatoes not visibly diseased for the purpose of being consumed upon premises in the occupation of the person by whom they were grown.

Notification of Disease.—The occupier of any premises in an infected area on which Wart Disease exists, or appears to exist, shall forthwith notify the fact by post or otherwise to the Board, or to the person authorised by the Board to receive such reports, who will forthwith forward the report to the Board. Where this Article applies the Article of the Wart Disease of Potatoes Order of 1914, relating to Notification of Disease, shall not apply.

Precautions against Spread of Disease.—The following measures for prevention of the spread of Wart Disease shall be adopted by each occupier of premises in an infected area:—

(*a*) The haulm, leaves and roots of each diseased plant shall be destroyed either by fire, or by some other method authorised by an Inspector of the Board, within 14 days from the date of lifting, either within the infected area or with the written authority of an Inspector of the Board at a place outside the infected area.

(*b*) Potatoes which are visibly diseased, if not forthwith destroyed by fire within the infected area, shall be thoroughly boiled as soon as possible, either within the infected area, or with the licence of an Inspector of the Board at a place outside the infected area.

(*c*) Litter or manure from any live stock which have been fed with potatoes grown on land within the infected area shall not be used as manure on any land outside the infected area.

Power to require Crop to be lifted.—An Inspector of the Board may, by notice served upon the occupier of any premises within an infected area, require him to lift any potatoes which the Inspector may suspect to be affected with Wart Disease by a date specified in such notice.

Copies of the above Orders can be obtained on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

American Gooseberry Mildew.

The Board of Agriculture and Fisheries desire to remind fruitgrowers, nurserymen, market gardeners, etc., in the county of Kent, that the Orders prohibiting, under a penalty not exceeding Ten Pounds, the movement of gooseberry and currant bushes, either from or within the county except by licence, are still in force

The Local Authority for the county of Kent have ceased to employ an Inspector for the purposes of these and other Orders under the Destructive Insects and Pests Acts, and all applications for licences should, therefore, be sent direct to the Board

MISCELLANEOUS NOTES.

Importation Regulations.

Importation of Plants into Mauritius.—Proclamation No. 81 of 1913, dated August 6th last, issued under the provisions of the Mauritius Ordinance No 4 of 1910, prohibits the importation of the following articles :—

Grape-vine cuttings and plants, except when covered by a certificate from the Board of Agriculture (or other competent authority) of the country of origin, that the vines have not been exposed to the infection of phylloxera for six weeks prior to the date of shipment

Earth and leaf and garden mould Dung or animal droppings (except guano) Forage. Timber with the bark on

Live plants of all sorts (including roots, tubers, cuttings, grafts, and buds) will be inspected at the port of entry, and if not found to be free from pests or diseases they may be disinfected or destroyed (*Board of Trade Journal*, January 22nd, 1914)

Importation of Plants by Post into Canada.—An Order in Council, dated December 4th, 1913, amends the regulations* under the Canadian "Destructive Insect and Pest Act" by prohibiting the importation through the post of all nursery stock, including trees, shrubs, plants, vines, grafts, scions, cuttings or buds, excepting greenhouse-grown florists' stock, cut flowers, herbaceous perennials and bedding plants, which will be admitted provided that a detailed statement of the contents is attached to the parcels containing such plants The amendment is to take effect from March 1st, 1914.

Importation of Potatoes into Bermuda.—The Board have received, through the Colonial Office, a copy of a telegram from the Governor of Bermuda stating that the importation of potatoes into Bermuda from Great Britain and Ireland was prohibited from January 12th, 1914.

It is stated that the measure has been adopted in order to prevent the introduction of injurious diseases, and to comply with the conditions imposed by the United States regarding the entry of potatoes from Bermuda into that country.

Importation of Milch Cows into Corea.—Ordinance No. 76 of July 19th, 1913, of the Government General of Corea, prohibits the importation into the country of milch cows unless—

(1) They have within 50 days undergone clinical examination and the tuberculin test at the hands of the authorities at the place of export and are provided with a certificate of health, or unless—

(2) They are clinically examined and subjected to a tuberculin test at the place of import and are deemed to be free of tuberculosis.

* See *Journal* for July, 1911, p. 341.

Notes on Agriculture Abroad.

Cattle Breeding in Sweden.—The Monthly Bulletin of Agricultural Intelligence of the International Institute of Agriculture for October, 1913, contains an article by Dr. Arenander, Professor at the Agricultural College, Ultuna, on the recent development of cattle breeding in Sweden.

It is stated that the northern position of Sweden makes it naturally more suitable for the rearing of live stock than for grain growing, more particularly in the north part of the country. The number of cattle in Sweden has greatly increased during the last half century; thus in 1865 the total number of cattle was 1,924,354, while by 1911 the number had risen to 2,689,609, an increase of 40 per cent, in spite of a considerable falling off in the number of steers due to their decreased use for work. The yield of crops for feeding purposes has been considerably increased; sugar beet growing in Sweden hardly existed 25 years ago, but by 1890, the yield was 220,700 tons, and in 1911 it had risen to 950,300 tons. The crop of mangolds, carrots, turnips and swedes has risen from 3,235,000 bushels in 1865 to 98,351,000 bushels in 1911

About 1840 general interest began to be aroused in Sweden in the improvement of cattle. The two breeds which proved most successful for crossing with indigenous breeds were the Ayrshire and East Frisian Towards the end of the last century importation was gradually discontinued and selection of breeding stock was adopted as the means of improving the strains of cattle Such good results have been obtained by this method that Swedish Ayrshires and East Frisians can compete with similar breeds in their own homes, and good prices have recently been obtained for exported animals of both breeds. In addition, great improvement has been made in the indigenous Fjall cattle by means of judicious selection, and there are now herds which give 6,000 lb of milk a year, which is very satisfactory for such small cows.

The annual production of milk has increased from some 3,100 million lb in 1875 to 13,200 million lb in 1910 There were in 1911-12 749 dairy control societies in Sweden, under which no fewer than 215,742 cows, or nearly 11 per cent of the total number, were submitted to careful control It was found that the average annual yield per cow was 5,748 lb of milk, with an average fat content of 3 5 per cent., corresponding to 201 lb of butter fat or 238 lb of butter

The chief factor in the improvement which has taken place in cattle in Sweden is probably the shows which are now held regularly. These shows are organised with the view of finding animals fit for breeding purposes and of classifying them according to their value Since 1892 such shows have been held throughout the country, grants being made by the Government and the agricultural societies towards prizes and other expenses In 1910, 62,670 animals were examined and 55,917, or 89 per cent, were approved or awarded prizes. The expenses for the year reached about £18,000

There are at present some 1,200 co-operative bull-keeping societies in the country, which are encouraged by the provincial agricultural societies by loans without interest for the purchase of bulls and by special prizes at the shows.

The Dairy Industry in Argentina.—According to H M. Minister at Buenos Aires, the Report of the Director-General of Rural Economy and Agricultural Statistics states that in 1912 a considerable increase of the dairy industry in Argentina took place. The number of dairies

increased from 1,160 to 1,259, the number of creameries from 398 to 525, butter factories from 10 to 16, and mixed establishments from 329 to 369, while the number of cheese-making establishments decreased from 158 to 129. The production of cream in 1912 was 334,000 cwt., of butter 195,000 cwt., and of cheese 111,000 cwt.; these figures showed increases of 41 per cent., 25 per cent, and 60 per cent., respectively, over the corresponding figures for 1911. The province of Buenos Aires produces the greater proportion of all dairy commodities, 71 per cent. of the milk and 61 per cent. of the cream used in the industry coming from this province, while the four large butter factories established in the Federal Capital made 62 per cent. of the total amount of butter produced. The price of milk at the farms varied from $\frac{3}{8}$*d.* to about 1*d.* per pint, the average being about $\frac{1}{2}$*d* The price of butter ranged from 10*d.* to 1*s.* 8*d.* per lb. The dairy industry is stated to be as yet only in its infancy in Argentina.

Annual Report of the Argentine Minister of Agriculture, 1912.—This Report draws attention to the extraordinary development which has taken place in Argentine agriculture during the last one or two decades. Since 1895 the area of land cultivated has increased from 12,083,000 acres to 56,793,000 acres The Ministry of Agriculture is endeavouring to place this rapidly expanding industry on a firm footing by (*a*) encouraging the use of the best seeds, machinery and methods of cultivation, (*b*) providing protection against plant pests; (*c*) organising agricultural education, and (*d*) facilitating the means of obtaining credit.

During the year the Department distributed gratuitously considerable quantities of pure seed of such crops as cotton, rice, tobacco, wheat and linseed. Official tobacco-drying sheds, which it is expected will soon be ceded to co-operative companies composed of the growers themselves, were erected in a number of districts The work of improving the quality of Argentine wheat by seed selection has been commenced, and an English expert has been engaged for the purpose The bad quality of imported maize has also been receiving attention and a North American expert is now investigating the matter

In order to improve the methods of combating plant pests, land is being acquired at Corrientes, Rosario, Bahia Blanca and Mendoza for the construction of offices and disinfecting chambers for plants and seeds It is intended to establish eventually an Inspection Office at each of these places to control the importation of plants and seeds.

There are at present eight schools for practical instruction, *i e*, dairy farming at Belle Ville (Cordoba); agriculture at Belle Ville (Corrientes), Las Delicias (Entre Rios), and Puerta de Diaz (Salta); fruit growing at San Juan, sub-tropical fruit growing at Cosados: forestry and industrial plants at Benitez Colony; and agricultural machinery at Bahia Blanca Schools of agriculture and dairy farming are also being established at 25 de Mayo and Olavarria respectively. Technical schools for the training of experts have been established at Mendoza (viticulture), Tucuman (sugar growing), and Cordoba (agriculture and stock breeding).

The general education of agriculturists is under the direction of some twenty instructors who have their headquarters at different towns in the Republic. These instructors answer enquiries, give lectures and short courses of instruction, make inspections and assist in promoting exhibitions. Their principal work is to give itinerant instruction in their respective districts. Arrangements are being made for the use of a number of trains to facilitate this work

Live Stock at the Panama-Pacific International Exhibition, 1915.—An exhibition of live stock will be held in connection with the Panama-Pacific International Exhibition at San Francisco, and will last throughout the period of the main exhibition, viz., from February 20th to December 4th, 1915. A sum exceeding £90,000 has been set aside for premiums and money prizes. Among interesting exhibits will be one of domestic animals from the Andes, to be made by the Argentine Republic A large exhibit of sheep is promised from Australasia.

The Weather in England during January.

District.	Temperature. Daily Mean.	Temperature. Diff. from Average.	Rainfall. Amount.	Rainfall. Diff. from Average.	Rainfall. Number of Days with Rain.	Bright Sunshine. Daily Mean.	Bright Sunshine. Diff. from Average.
Week ending Jan 3rd .	°F.	°F.	Inches	Inches		Hours	Hours.
England, N.E. ...	33·5	−4·4	0·59	+0·17	3	2·6	+1·5
England, E.	34·3	−3·1	0·16	−0·29	3	2·6	+1·3
Midland Counties ...	33·2	−4·1	0·23	−0·32	3	2·2	+1·1
England, S.E.	34·8	−4·6	0·12	−0·42	2	2·6	+1·2
England, N W.	36·5	−2·7	0·15	−0·53	2	1·8	+0·9
England, S.W. ..	36·4	−4·8	0·20	−0·71	3	2·7	+1·3
English Channel .	41·5	−3·6	0·20	−0·60	5	2·2	+0·3
Week ending Jan 10th							
England, N.E.	40·2	+2·4	1·02	+0·60	5	1·3	+0·2
England, E.	41·5	+4·2	1·25	+0·80	5	1·4	+0·1
Midland Counties	41·9	+4·7	0·66	+0·11	5	1·3	+0·1
England, S.E .	43·0	+3·9	0·51	−0·03	5	1·6	+0·2
England, N.W. ...	42·5	+3·4	1·44	+0·76	6	0·9	−0·1
England, S W. .	44·1	+3·1	0·99	+0·08	6	1·2	−0·3
English Channel	47·1	+2·6	0·97	+0·17	6	1·7	−0·2
Week ending Jan 17th							
England, N E	36·4	−1·7	0·30	−0·16	6	0·3	−0·8
England, E . . .	35·2	−2·1	0·11	−0·28	4	0·9	−0·5
Midland Counties	34·6	−2·8	0·05	−0·41	2	0·6	−0·7
England, S E ...	35·0	−4·1	0·05	−0·45	2	1·4	0·0
England, N W.	35·7	−3·6	0·03	−0·59	1	0·9	−0·2
England, S W. ...	35·1	−5·9	0·01	−0·77	1	1·3	−0·3
English Channel	38·9	−5·3	0·08	−0·61	2	2·1	+0·1
Week ending Jan 24th							
England, N.E ..	35·5	−3·4	0·09	−0·31	3	0·8	−0·6
England, E ..	33·5	−4·6	0·04	−0·32	2	1·0	−0·6
Midland Counties ...	33·0	−5·3	0·02	−0·42	1	1·1	−0·4
England, S.E ...	31·8	−8·0	0·00	−0·49	0	1·2	−0·3
England, N.W. ...	35·2	−4·8	0·14	−0·54	1	1·2	0·0
England, S W. ...	34·0	−7·6	0·02	−0·76	1	1·3	−0·3
English Channel ...	36·9	−8·8	0·03	−0·59	1	2·3	+0·2
Week ending Jan. 31st							
England, N.E. ...	43·8	+4·4	0·12	−0·22	3	1·7	0·0
England, E.	42·0	+3·1	0·05	−0·33	2	1·1	−1·0
Midland Counties ...	43·3	+4·2	0·27	−0·23	4	1·1	−0·6
England, S.E.... ...	42·1	+1·8	0·41	−0·10	4	0·9	−0·9
England, N W. ...	44·7	+4·4	0·74	−0·01	6	1·0	−0·4
England, S.W. ...	44·7	+2·8	0·86	+0·01	6	0·6	−1·1
English Channel ...	45·7	+1·0	0·40	−0·25	6	1·1	−1·1

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural and Commercial Statistics* for January, 1914, issued by the International Institute of Agriculture, contains estimates of the areas sown with winter cereals in several countries of the northern hemisphere. The areas sown with *wheat*, compared with the areas sown during the corresponding period of 1912, expressed as percentages, are as follows :—Denmark, 100, Great Britain (excluding Scotland), 109; Italy and Luxemburg, 100; Switzerland, 101; Canada, 93; United States, 109, India, 87; and Tunis, 80. The areas sown with *rye* are —Denmark, Italy and Luxemburg, 100, Switzerland, 96; and United States, 99; with *barley* —Italy and Luxemburg, 100; Switzerland, 121; and Tunis, 112; and with *oats* —Italy, 100; and Tunis, 93

Canada—The final figures of the harvest of 1913 place the production of wheat at 28,957,000 qr., an increase, as compared with 1912, of 16 3 per cent. Rye amounted to 268,000 qr., a decrease of 11.3 per cent, barley to 5,797,000 qr., an increase of 9 8 per cent., oats to 44,086,000 qr., an increase of 11.9 per cent, and maize to 1,956,000 qr., an increase of 1.2 per cent

Japan.—According to the final figures, the production of wheat in 1913 was 3,150,000 qr., or 1 9 per cent. less than in 1912 Barley amounted to 13,081,000 qr., or an increase of 9 5 per cent

Australia.—The area from which wheat will be taken in 1913–14 is estimated at 9,107,000 acres, or 24 per cent. more than in 1912–13 The production is estimated at 14,164,000 qr. compared with 11,493,000 qr in 1912–13, the increase amounting to 23 per cent

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Sugar Beet.—The production in Austria, Hungary (proper), Prussia, Belgium, Denmark, Spain, France, Italy, Netherlands, Rumania, Russia in Europe (63 governments), Switzerland, Canada, and United States is estimated at 55,969,000 tons, as compared with 55,714,000 tons in 1912, the increase being equal to 0 5 per cent

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France.—The areas sown with grain up to January 1st, are officially estimated as follows (in acres):—Wheat, 15,651,402, compared with 15,561,494 at the same date in 1913; oats, 2,065,192, compared with 2,036,095; rye, 2,937,719, compared with 2,855,221; and barley 348,344, compared with 380,726. The condition of wheat on the 1st January was 75 (71 in 1913), of oats 76 (73 in 1913), of rye 75 (71 in 1913), and of barley 74 (73 in 1913) (*Journal Officiel* (France), January 19th)

Canada.—The final estimates of the produce of the crops of 1913, issued by the Census and Statistics Office at Ottawa, are as follows (in bushels and 1912 figures in brackets):—

Wheat, 231,717,000 (224,159,000); oats, 404,669,000 (391,629,000); barley, 48,319,000 (49,398,000). The wheat and oat crops of 1913 are the highest on record in Canada, as regards both area and production. The quality of the grain crops, as indicated by the average weight per measured bushel, is excellent and is superior to that of 1912.

Argentina.—The first official forecast gives the following estimates of the production of this season's (1913-14) crops (in quarters). Wheat, 16,438,000; barley, 964,000; oats, 7,205,000; rye, 390,000; and maize, 41,000,000. It is at present too early to forecast the yield of the maize crop with any accuracy. (H.M. Minister at Buenos Aires, December 31st, 1913.)

(The production of wheat in 1912-13 was estimated at 24,795,000 qr., that of oats at 11,881,820 qr., and that of maize at 22,958,333 qr.).

Chile.—The barley harvest is expected to be a good one this year, as the crop has successfully withstood the prolonged drought The wheat yield, on the other hand, will probably only suffice for home requirements, leaving no surplus for export. (*Review of the River Plate*, January 16th.)

New Zealand.—The areas under cereals this season are officially estimated as follows (in acres, and 1912-13 figures in brackets):—Wheat, 166,774 (189,869); oats, 361,741 (386,786), barley, 32,022 (37,486) (*Broomhall's Corn Trade News*, January 22nd.)

South Australia.—This season's production of wheat (grown for grain) is officially estimated at 19,491,585 bushels, compared with 21,496,216 bushels in 1912-13

India.—According to the first General Memorandum on the wheat crop of 1913-14 the total area under the crop, reported up to January 1st, was about 22,339,000 acres as compared with 25,688,000 acres (revised figure) at the same date last year—a decrease of 13 per cent. The sowing season has not, on the whole, been favourable in the important wheat-growing tracts. The present condition of the irrigated crop is reported to be generally good, but the un-irrigated crop is frequently suffering from want of moisture.

Live Stock in Japan.—The number of cattle at the end of 1912 was 1,399,498 as compared with 1,405,026 at the end of 1911, the decrease being equal to 0.4 per cent. Horses totalled 1,581,743, against 1,576,146, an increase of 0.4 per cent.; pigs, 308,970, against 298,709, an increase of 3.4 per cent; and sheep, 3,308, against 3,736, a decrease of 11 5 per cent. (*Bulletin of Agricultural and Commercial Statistics*, January, 1914.)

Live Stock in Germany.—The *Deutscher Reichsanzeiger* recently published figures showing the estimated values of the different classes of live stock in Germany. The 1912 Census, published in the same periodical, gave the numbers of the various species as:—horses, 4,523,059; cattle, 20,182,021; sheep, 5,803,445; swine, 21,923,707; and goats, 3,410,396. The approximate value per animal of each class as obtained by combination of these figures is as follows:—Horses, £37; cattle, £17 10*s.*; sheep, £1 12*s* 6*d.*; swine, £3 18*s.*; and goats, £1 6*s.* In considering these values, however, it must be borne in mind that the figures represent animals of all ages. The numbers of the various species in 1907 were:—Horses, 4,345,047; cattle, 20,630,544; sheep, 7,703,710; and pigs, 22,146,532.

Agricultural Conditions in England and Wales on February 1st.

The Crop Reporters of the Board, in reporting on the agricultural position on 1st February, state that the dry weather, which was accompanied by some frost, during the past month has been of general benefit to agriculture, though in the north-west some reporters say that more cold weather would be desirable to check the corn crops.

Wheat is generally a strong and healthy plant, and presents a very satisfactory appearance, with the exception, in some districts, of that sown late. In some parts of the country it is thought to be perhaps rather too forward, but the cold spell has generally given a useful check in this respect. Winter oats and beans are also very promising. The frost also gave very generally the opportunity of carting manure, while much ploughing and preparation of the soil have been done, farm work practically everywhere being thus exceptionally forward.

The condition of ewes and lambing prospects are reported to be very satisfactory, largely owing to the favourable weather The Dorset Horn flocks have generally finished lambing; in some parts of Dorset the fall of Horn lambs is reported to be very good, and elsewhere quite up to average, though one district reports some loss among the ewes Among the few other flocks in which lambing has commenced in different parts of the country, the fall is considered satisfactory; twins are not very numerous, but, on the other hand, the lambs are generally strong and healthy, and there are very few losses.

The dry, open weather of the month has suited all kinds of live stock, which are everywhere thriving. Keep is generally quite sufficient, and even plentiful, a shortage of roots being fully balanced by a sufficiency of hay, while the pastures have yielded more feed than usual at this time of year.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on February 1st, 1914, certain diseases of animals existed in the countries specified:—

Austria (*on January 28th*).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 544 Hofe infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis

Belgium (*for the period January 1st—15th*).

Anthrax, Blackleg, Foot-and-Mouth Disease (17 outbreaks in 14 communes), Foot-rot, Rabies.

Bulgaria (*for the period December 22nd—29th*).

Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Sheep-scab.

Denmark (*month of December*)

Anthrax, Foot-and-Mouth Disease (1 outbreak), Swine Erysipelas, Swine Fever.

France (*for the period January 18th—24th*).

Anthrax, Blackleg, Foot-and-Mouth Disease (169 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period January 1st—15th).
Foot-and-Mouth Disease (194 infected places in 52 parishes), Swine Fever.

Holland (month of December).
Anthrax, Foot-rot, Glanders, Swine Erysipelas.

Hungary (on January 7th)
Anthrax, Dourine, Foot-and-Mouth Disease (total of 1,576 " cours " infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period January 12th—18th).
Anthrax, Blackleg, Foot-and-Mouth Disease (677 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period August 15th—November 1st).
Anthrax, Foot-and-Mouth Disease, Glanders and Farcy.

Norway (month of December)
Anthrax, Swine Fever.

Rumania (for the period January 5th—13th).
Anthrax, Dourine, Foot-and-Mouth Disease (20,233 animals), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Russia (month of September).
Anthrax, Foot-and-Mouth Disease (46,055 animals in 560 " communes "), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (no further returns received).

Spain (month of November).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (6 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of December).
Anthrax, Blackleg, Swine Erysipelas

Switzerland (for the period January 19th—25th).
Anthrax, Blackleg, Foot-and-Mouth Disease (434 " étables " entailing 5,125 animals, of which 37 " étables " were declared infected during the period), Swine Fever.

THE CORN MARKETS IN JANUARY.

C. KAINS-JACKSON.

British Wheat—The markets seldom have much grain on offer during the first half of January. During the last fortnight, however, deliveries are frequently rather liberal, and this year the dry weather favouring condition has led to free sales. The demand in London, while not so good as in January, 1913, has been larger than in January, 1912 Prices for the Metropolis show little net change on the year, but were about half a crown lower than in 1912 There was not much demand for seed corn ; sowing was well on before the end of 1913. The month closed with 35s. made for fine white fluffs, and 33*s*. 6*d*. accepted for ordinary Norfolk Red, each per 504 lb. The price of 30*s*. per 448 lb. for poultry corn works out at 32*s*. 3*d*. per statute average (480 lb.) and is somewhat significant in indicating, as it must be held to do, that poultry owners are now competing for wheat with millers This is a new

feature in demand, for the poultry interest was not expected to put in an appearance until millers were satisfied.

Colonial and Indian Wheat.—The buyers of Canadian wheat have been in a somewhat remarkable position, having had more No. 1 and No 2 offered to them than their mixtures required, while they have found the quantity of No 3 and No 4 on offer inadequate. Further, the coarse but serviceable sorts, No. 5 and No 6, were not on the market at all. Prices have been about 36*s.* for No. 1, and 35*s.* for No. 2, but the month closed with 36*s.* 6*d.* asked for No. 1, and 35*s.* 9*d.* paid for No. 2. This would seem to show that demand had fully overtaken supply. Indian wheat has been scarce and dear, 38*s.* being paid for white, and, 37*s.* 6*d* for red. Australian and New Zealand have been very scarce on spot and held for about 37*s.*; but the new crop of Australian has been freely offered for sale at 36*s.* as soon as the ships come in.

Foreign Wheat.—Only 135,000 qr. of Russian wheat were on passage to this country at the end of January, so that holders were very firm They got 36*s.* for the best Baltic types, and 34*s.* 6*d.* for the best Black Sea sorts, each weighing 492 lb net The offers of new Argentine crop at 35*s.* cash on the ships coming in have not been injurious to the value of 1913 wheat, for the new corn from La Plata is said to be decidedly inferior in quality. Thus the 1913 grain made 37*s* per qr. United States average wheat has fallen from 7*s* 4*d* to 7*s.* 3*d.* per cental, being a firm market at the latter price. This wheat is known as No 2 Red Winter, and 7*s* 3*d* per cental equals 34*s.* 10*d* per 480 lb No 1 Northern Spring, usually 1*s* to 2*s* per qr. dearer than Red Winter, was at 35*s.* 8*d*, so that the difference between the two sorts is less than usual.

Wheat Supplies and Shipments—The Australian wheat crop was cabled on the 30th as 13 3 bushels per acre, which on acreage works out at 14,107,000 qr. The yield by weight is probably about 3 per cent. better than this, as the newly threshed corn is turning out 62, 62½, and even 63 lb. to the bushel, and the Australian corn trade follows British use of a quarter of 480 lb If the yield be in reality about 14,530,210 qr. (480 lb) the exportable surplus should amount to fully 8½ million quarters. The January exports reached 1,371,000 qr. against 375,000 qr, 583,000 qr, 726,000 qr. and 943,000 qr. for the four preceding Januaries Other exporting countries presented much more ordinary figures. North America sent off almost exactly 2,000,000, qr. Eastern and South Eastern Europe 2,800,000 qr., India 108,000 qr, and Argentina 349,000 qr The total for Eastern and South Eastern Europe was not unusual, but the division, 1,450,000 qr. Russian, 1,350,000 qr. Europe South Eastern, was remarkable for the increased importance of the second return The Argentine shipments of new wheat were materially below the average Imports for the month were very moderate, but the effect was entirely neutralised by the great increase in the supply on passage, which, standing on New Year's Day at 1,470,000 qr., had reached 2,610,000 qr. by Candlemas. The stocks in the 15 great ports on 31st January were estimated at 1,800,000 qr.

Flour.—The manufactured article was never a good market in January, and from the 23rd to the 31st, when the temperature was high the trade was very bad indeed Before the month closed, top price was down to 31*s*, Town Whites to 29*s.*, fine American London ground to 28*s.*, Town Households to 26*s*, good Country Patents to 25*s.* 9*d.*,

American First Bakers to 25*s*, and Country Roller Whites to 23*s*. 6*d*. These low prices are of course cash terms. North American shipments for the month were nearly 600,000 sacks, and 230,000 sacks were on passage on the 31st.

Barley.—Large sales of robust but weathered barley marked the month, both in London and in the country markets. The price has averaged about 27*s*. in the one case and 26*s*. in the other. Californian barley declined 1*s*. on the month, 34*s*. 6*d*. for No. 1 and 32*s*. 6*d*. for No. 2 being the closing prices. Russian barley has been steady at a guinea. January shipments were 1,401,000 qr. from Russia, 404,000 qr. from Europe South East, 115,000 qr. from California, 105,000 qr. from Atlantic ports, and 16,000 qr. from India. There were on the 31st, 195,000 qr. on passage from California, 80,000 from Russia, 20,000 from Europe South East, 35,000 from India, 40,000 from the Levant, and 50,000 from Atlantic Ports.

Oats.—The one event of this trade in January was the rush to ship the new Argentine crop The quantity which left for England and Europe was 936,000 qr against 735,000 qr., 162,000 qr., 560,000 qr. and 272,000 qr, respectively, in the four preceding Januaries. The price did not, as a rule, fall below five shillings per cental—a low quotation. Other sorts were rather at a discount, except where good weight was shown, when they sold steadily. On the 31st half a million quarters were on passage Russian shipments for the month were 475,000 qr, and 170,000 qr. were exported from all sources in S.E. Europe and the Levant

Maize—On the 23rd the senior Shipping List published an exhaustive survey, according to which the world production, to be drawn upon in 1914, was only 414,288,000 qr. against 509,879,000 in 1913. Yet prices have fallen 2*d* per cental on the month and value is 4*d*. per cental lower than on 1st February, 1913 The demand for Argentine new crop for June shipment is already brisk, and over a million quarters are reported to have been contracted for at a cost of about 22*s* per qr. At existing quotations, say 4*s*. 10*d*. per cental for yellow and 5*s*. for round, the buyer is in a fairly fortunate position January exports were 52,000 qr. from North America, 1,137,000 qr. from South America, 170,000 from Russia, and 495,000 from Europe S E. The Burmese, South African, and East African ports failed to ship anything appreciable. On the 31st there were 620,000 qr. on passage, as compared with 905,000 for a year previously, but 375,000 qr. only on 31st January, 1912. On the whole, current expectation may be described as about an average

Oilseeds—From the New Year the quotations for Indian linseed have been on a pure basis—that is to say, delivery of absolutely pure seed is aimed at, and the buyer will receive compensation for even a very small quantity of impurity, and be able to reject the cargo if the percentage is at all heavy. This high class policy has resulted in prices improving for Indian produce, and has created an excellent impression. Prices for sound Indian on 31st January were: 1914, 47*s* 6*d*. per qr.; 1913, 46*s*. 9*d*., 1912, 61*s*. 9*d*.; and 1911, 69*s*. 9*d*. For Argentine they were respectively 42*s*., 44*s*, 62*s*., and 70*s*. per quarter. Prices at Buenos Aires fell 1*s*. on the month. There were on the 31st some offers of fine English, Dutch and Russian at 54*s*. per 424 lb. Imports into London for January were about 40,000 qr., and into Hull about 60,000 qr. The supply on passage at the close of the month was 255,000 qr., against

140,000 a year ago. Shipments for January were 165,000 qr. from India, 740,000 qr. from Argentina, and 10,000 qr. from Russia. Germany has been buying cottonseed freely, but the market has lost ground. Theoretically this oilseed should advance in price, for stocks at Alexandria are 15 per cent. smaller than they were a year ago There were, however, 66,000 tons on passage to England, and until this large quantity has gone into use the importer can hardly hope to have the exchange with him

Various.—With beet sugar well under ten shillings per cwt., and a visible supply 300,000 tons larger than a year ago, all the fattening foods with a sugar basis remain cheap, and command in consequence a good sale Other cheap articles are brewers' grains, haricots, and the different condiments which help many nutritious but flavourless foods to occupy a place among feeding stuffs. Staples, which are just now abnormally dear, include Dari, the best lots of which have touched 50*s.* per 480 lb., and canary seed, for a bold sample of which £5 per quarter continues to be paid

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THE LIVE AND DEAD MEAT TRADE IN JANUARY.

A. T. MATTHEWS.

Fat Cattle.—The total supplies of fat cattle coming to English markets during the first three weeks of the new year were about three thousand less than the average of the last three years, or about an 8 per cent reduction. Prices, however, have fluctuated only to a small extent, and remain very nearly the same as in December, and similar to those ruling a year ago Values at the different markets have been irregular, and a range of 1*s* per 14-lb stone for first quality Shorthorns has been a frequent occurrence, even between markets of equal importance When this happens for several consecutive weeks the question arises whether farmers are taking full advantage of the more reliable information now available in their choice of markets

In about 30 English and Welsh markets the average price of Shorthorns during January was 8*s* 10*d* and 8*s* 2*d* per 14-lb stone, against 8*s* 11*d* and 8*s.* 1*d* in December; Herefords, 9*s* and 8*s* 5*d*, against 9*s.* and 8*s.* 5*d* ; Devons, 9*s* and 8*s* 3*d*, against 9*s* and 8*s* 4*d* , Welsh Runts, 8*s.* 10*d.* and 8*s* 5*d*, against 8*s* 9*d.* and 8*s.* 1*d* , and Polled Scots, 9*s.* 1*d.* and 8*s* 8*d*, against 9*s* 3*d.* and 8*s* 7*d.* These figures represent the average values of first and second quality respectively, and do not include the quotations for fat bulls and cows, which realised about 1s to 1*s* 6*d* per stone less than the second quality London was well above the general average for all the better classes of cattle during January, but values at Ipswich have been still better, while Bristol has been persistently low, probably owing to deficiency in the quality and condition of supplies.

Veal Calves —The demand for fat calves has been very good for the coldest month of the year, when veal is considered out of season. Averages have not been quite so high as in December, but 9½*d.* and 8½*d.* per lb. for first and second quality are very fair prices in midwinter.

Fat Sheep.—The supplies have been very fair, and for the first three weeks were only about 1,750 per week below the three-year average. The demand has been steady and, in spite of many fluctuations in individual markets, average prices have remained remarkably uniform, not only week by week through January, but also when compared with those of December. Longwools have come very near in value per lb. to the Downs, owing to the extra value of their skins at this time of year. In about 23 English markets Downs averaged 10*d.*, 9*d.*, and 7½*d.* for the three qualities, against 10*d*, 9½*d*, and 7½*d.* in December; Longwools 9¾*d.*, 8¾*d.*, and 7*d.*, or exactly the same as the previous month Prime Cheviots and first quality Cross-breds averaged 10½*d* and 10*d.* respectively, these again fairly maintaining their December average. Those tabulated as "Cross-breds" are quoted in about 26 markets, but vary extremely in different districts, including as they do the choice Scottish Half-bred Leicester-Border-Mountain and the much heavier sheep produced by a Down and Longwool cross

Fat Lambs—The season for fat lambs has really only just commenced, and the numbers exposed have been inconsiderable. These have been selling at about the usual prices, and in the last week of January averaged in four markets 13¾*d.* and 12½*d.* per lb. for first and second quality.

Fat Pigs.—In view of the shortage in the numbers of pigs in the country it is not surprising that the month witnessed only a very slight decline in the value of fat pigs. The January average in nearly 30 markets was 8*s* 2*d* and 7*s* 9*d.* per 14-lb. stone, against 8*s.* 3*d.* and 7*s.* 10*d.* in December These prices, however, are about 7*d.* per stone below those of last August

Carcass Beef--British—The trade for home-killed beef in London has been marked by extreme quietude, dealers complaining of the very dull demand. Yet prices were, if anything, better than those of December except in the week before Christmas. Scotch short sides made 4*s* 8*d* and 4*s* 6*d* per 8-lb. stone each week till the last, and long sides were equally steady at 4*s* 4*d.* to 4*s.* 6*d.* English made 4*s* 2*d* to 4*s* 4*d*, and Irish 4*s.* to 4*s.* 2*d* In the last week the trade collapsed, and prices fell 2*d* per stone all round, doubtless owing to the bad weather conditions. The Irish supplies were again very small

Chilled Beef—Hind quarters of Argentine chilled have varied from 3*s* 4*d.* up to 3*s* 8*d.* for the best quality, the averages being 3*s* 6*d* and 3*s.* 3*d.* for first and second. Fore quarters averaged 2*s.* 10*d.* and 2*s* 8*d.*

Frozen Beef—The trade for "hard" beef has again been quiet and featureless, with prices scarcely showing any change. These were about 2*s.* 9*d* to 3*s* per 8-lb for Argentine and Australian hind quarters, and 2*s* 6*d.* to 2*s.* 8*d* for fores. Very little New Zealand beef has come to hand.

Carcass Mutton.—Fresh Killed—The enquiry for British mutton at the London Central Market has been very small, and clearances have been effected with difficulty. Prices have also been lower than in December for both Scotch and English, and are out of all proportion to the values of live sheep. It is surprising therefore that the market at Smithfield should continue to receive such considerable supplies. Scotch averaged 5*s.* 5*d.* and 5*s.* 1*d.* per stone, and English 5*s.* 1*d.* and 4*s.* 9*d.*, Dutch tegs making 5*s.* 2*d.*

3 X 2

Frozen Mutton.—New Zealand carcasses have been so sparingly offered as to be scarcely worth quoting. Argentine and Australian mutton has, however, been fairly supplied, and has sold relatively well. Its value has been 2*s*. 7*d*. to 3*s*. per 8 lb., according to quality.

Lamb.—British.—Only very small supplies have come to hand, though quite enough for the demand. Prices have been by no means high, ranging from 6*s*. 4*d*. to 7*s*. 4d. per stone.

Frozen Lamb.—Some new season lamb from New Zealand has realized high prices, making 8*d*. per lb. in the second week, the month closing at 7½*d*. Argentine and Australian have also sold well, making from 3*s*. 7*d*. to 4*s*. 2*d*. per stone.

Veal.—Choice veal has been scarce and very dear, but like other meat, slackened off in the last week The best Dutch realized 6*s*., and English 5*s*. 8*d*. per stone Inferior and small calves have been more than sufficiently abundant, and have sold at very low prices.

Pork.—There was a slight reduction in the value of pork as compared with December rates. Prices for English were steady at 4*s* 8*d*. to 5*s*. per stone till the last week, when there was a reduction of 4*d*. per stone.

THE PROVISION TRADE IN JANUARY.

HEDLEY STEVENS.

Bacon.—As usual, at this time of the year, the consumptive demand for bacon and hams in January was only moderate.

Prices fluctuated to a small extent, but at the end of the month were a trifle firmer. Arrivals from Denmark were well up to the average, but with smaller arrivals from Holland there has not been any accumulation of stock from the former country Holland has also been sending pork, as well as pig carcasses for curing in this country.

There was a good demand for Russian and Polish bacon, on account of their comparative cheapness.

There was the usual scarcity of lean bacon at this season, and in consequence it was held for better prices

The scarcity of both English and Irish pigs continues to cause anxiety amongst curers, and it is generally expected that the present high prices will be maintained, the supply not being sufficient to fill the demand.

All advices from America point to strong markets, and packers demand extreme prices for forward shipments, anticipat ng that the raw material will cost them more.

The American Hog Census, as taken on January 1st, shows a shrinkage of about 3 per cent., the figures being 58,933,000 as against 61,178,000 last year, and 65,620,000 three years ago

On account of the scarcity of beef, and the consequent high prices, all American advices report a good home consumption of hog products, which is likely to continue, and hence decrease the quantities available for export.

At Chicago during the month, prices for hogs ranged from \$7.70 to \$8.55, against \$7,00 to \$7.75 last year, and \$5.60 to \$6.60 two years ago.

Canada continues to send less bacon to England, and there are prospects of a still larger reduction in the quantity available for export from that Colony. In 1913, 12,176 tons were shipped to this country, against 30,790 tons two years ago (1911)

Cheese.—Trading has been irregular throughout the month, principally owing to uncertainty in regard to the effect on the English markets of the large quantities of New Zealand cheese to arrive during the next few months. At the end of January the quantity shipped *en route* to this country (including a steamer with 39,800 then due), amounted in the aggregate to 363,600 cheese. These abnormal shipments are due to the labour troubles of a few weeks ago, which caused an accumulation of freight, and disorganisation of the steamship service

Against this increase in New Zealands, amounting to nearly 30 per cent. in the season's shipments to the end of January, there is a shortage of over 150,000 cheese in the season's shipments from Canada, and stored stocks in Canada are now very small. It is estimated that the shortage in the season's make amounted to 200,000 cheese

Stocks of Canadian cheese at the three principal distributing centres (London, Liverpool and Bristol) at the end of the month were 123,000 against 210,000 last year, and 206,000 two years ago.

Stocks of New Zealand cheese at London and Bristol were 12,700 crates (two cheese in each) against 14,000 crates last year, and 10,100 crates two years ago

On the month prices of Canadians and New Zealands were a little higher at the close, and from 5*s*. to 7*s*. per cwt. above last year's prices at the same time

The trade in English cheese has continued fair, at prices from 4*s* to 6*s* per cwt above those current at the same time last year in the case of Cheddars, but a smaller difference for Cheshires. Stocks in the West of England are said to be under the average for the time of year

Butter—Arrivals were large throughout the month and in consequence lower prices have been accepted to force business, the quotations being about 3*s*. to 4*s*. per cwt. lower at the end of the month To effect sales of a large quantity, business has been done at from 5*s*. to 6*s*. reduction.

With very large shipments on passage from Australia and New Zealand dealers are anticipating still further reductions in prices, as stocks cannot be cleared quickly enough.

It will require a very brisk trade during February and March to absorb the large shipments, but much will depend upon the weather.

Practically no butter is coming from Canada or the United States of America.

Unit Prices of Artificial Manures.

Statement of cost to the purchaser of 1 per cent. per ton of Nitrogen, Soluble and Insoluble Phosphates, and Potash derived from

	London.	King's Lynn.	Hull.	Newcastle.
	s. d	*s. d*	*s d.*	*s d.*
Nitrogen from:				
Sulphate of Ammonia 95% pure .	13 2	13 9	13 2	13 0
Calcium Cyanamide ...	11 10	12 4	11 10	12 3
Nitrate of Soda pure 95%	14 10	14 8	14 6	15 0
Nitrate of Soda pure 90%	—	—	—	—
Nitrate of Lime	15 10	16 0	15 4	15 4
Soluble Phosphates from .				
Superphosphate 35%	1 8	1 7½	1 8½	1 10½
,, 33%	1 8½	1 7½	1 9	1 11
,, 30%	1 8½	1 8	1 9	1 11
,, 26%	1 10	1 9	1 10	2 1
Dissolved Bones ...	2 6	2 6	2 5	2 5
Allowed for Nitrogen	*18 0*	*17 7*	*17 2*	*16 5*
Allowed for Insol Phos	*1 10*	*1 10½*	*1 8½*	*1 9*
Insoluble Phosphates from:				
Basic Slag	1 6	—	1 4	1 3
Bone Meal	1 7½	1 7	1 6½	1 6
Allowed for Nitrogen	*15 7*	*15 4*	*14 0*	*14 6*
Steamed Bone Flour .	1 4	1 6	1 4	1 4
Allowed for Nitrogen	*12 9*	*14 0*	*13 3*	*13 0*
Potash from:				
Kainit	4 1	3 11	3 10	4 3
Sulphate of Potash ...	4 7	4 3½	4 4½	4 11½
Muriate of Potash ..	3 11	3 7	3 6½	—
Potash Salts	—	—	—	—

NOTE —These unit prices are based on the probable retail cash prices in bags f o r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified They are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the per-

various sources, at certain Ports and Manufacturing Centres, for February, 1914.

Silloth.	Liverpool	Widnes.	Newport.	Bristol.	Plymouth.
s. d.	*s d.*	*s d*	*s d*	*s d.*	*s. d*
13 2	12 11 93% pure.	12 10 93% pure.	13 7	13 5	14 2
—	11 10	—	11 11	11 10	11 10
14 6	13 7	13 6	15 6	15 3	14 6
—	13 7	—	—	—	—
—	—	—	16 1	15 6	15 6
1 10½	1 9½	1 8½	1 10	1 10	1 10
—	1 9½	1 8½	1 10½	1 10	1 10½
1 11	1 9½	1 8½	1 10½	1 10	1 10½
2 1	1 11	1 10	2 0	2 0	2 0
2 6	2 6	2 6	2 7	2 7	2 8
17 7	*18 3*	*18 3*	*18 7*	*18 5*	*18 10*
1 10	*1 11*	*1 11*	*2 0*	*1 11*	*2 0*
—	1 3	1 2	1 4½	1 7	1 7½
1 7	1 6½	1 6	1 6	1 4½	1 7
15 3	*14 7*	*14 6*	*13 7*	*13 5*	*15 7*
1 5	—	—	1 3	1 4½	1 5
13 8	—	—	*13 2*	*13 5*	*13 0*
4 3	4 4½	4 3	4 7	4 4	4 4½
4 10	4 5½	4 6	4 11	4 11	4 9
4 0	3 8½	3 8½	4 0	4 2½	4 3
3 3½	—	—	—	—	—

centages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and re-bagging the ingredients, bags, and loss of weight.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in January, 1914, and December, 1913.

(Compiled from Reports received from the Board's Market Reporters.)

Description	January, 1914. First Quality.	January, 1914. Second Quality.	December, 1913. First Quality.	December, 1913. Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 1	8 8	9 3	8 7
Herefords	9 0	8 5	9 0	8 5
Shorthorns	8 10	8 2	8 11	8 1
Devons	9 0	8 3	9 0	8 4
Welsh Runts	8 10	8 5	8 9	8 1
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	9¼	8¼	9½	8½
Sheep :—				
Downs	10	9	10	9¼
Longwools	9¾	8¾	9¾	8¾
Cheviots	10¼	9½	10½	9¾
Blackfeds	10¼	9½	10¼	9¼
Welsh	9¾	9	9¾	8½
Cross-breds	10	9	10	9
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	8 2	7 9	8 3	7 10
Porkers	9 0	8 7	9 2	8 8
LEAN STOCK :—	per head	per head	per head	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk .	24 5	20 7	24 9	20 10
,, —Calvers ...	22 10	18 18	24 13	20 11
Other Breeds—In Milk ..	21 16	17 16	21 1	18 4
,, —Calvers .	—	15 10	—	16 0
Calves for Rearing ...	2 12	1 19	2 12	1 19
Store Cattle :—				
Shorthorns—Yearlings ...	11 13	10 5	11 10	10 1
,, —Two-year-olds.	15 10	13 15	14 19	13 7
,, —Three-year-olds	19 7	16 12	18 15	16 12
Herefords —Two-year-olds..	17 4	15 3	17 8	14 10
Devons— ,,	15 5	13 3	15 16	13 11
Welsh Runts— ,,	—	—	15 5	13 0
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	48 9	42 6	46 8	40 3
Store Pigs :—				
8 to 12 weeks old	26 5	20 4	25 9	19 4
12 to 16 weeks old	39 11	30 2	38 4	29 8

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in January, 1914.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality	Birmingham s.	Birmingham d.	Leeds s.	Leeds d.	Liverpool s.	Liverpool d.	London s.	London d.	Manchester s.	Manchester d.
		per cwt.		per cwt		per cwt		per cwt		per cwt.	
BEEF:—											
English	1st	58	6	58	6	56	6	60	6	57	0
	2nd	55	0	56	6	52	0	58	0	53	0
Cow and Bull	1st	53	0	53	6	47	0	48	0	49	6
	2nd	46	6	49	6	41	0	43	0	45	0
Irish: Port killed	1st	—		55	6	56	6	58	6	—	
	2nd	53	6	53	6	52	0	56	0	—	
Argentine Frozen—											
Hind Quarters ..	1st	44	6	44	6	43	6	41	6	43	6
Fore ,, ...	1st	39	0	39	0	38	6	37	0	38	6
Argentine Chilled—											
Hind Quarters	1st	48	0	48	0	47	0	49	6	47	0
Fore ,, ...	1st	39	6	40	0	38	6	39	6	38	6
Australian Frozen—											
Hind Quarters .	1st	42	6	42	0	42	0	41	6	42	0
Fore ,, .	1st	38	6	38	0	37	6	37	6	37	6
VEAL:—											
British	1st	—		74	6	84	0	79	6	80	6
	2nd	74	6	70	0	74	6	70	6	74	6
Foreign..	1st	—		—		—		83	0	—	
MUTTON:—											
Scotch	1st	—		—		87	0	76	0	85	6
	2nd	—		—		82	0	71	0	81	6
English	1st	77	0	79	6	81	6	71	6	80	0
	2nd	66	6	76	6	77	0	67	0	74	6
Irish: Port killed	1st	74	6	—		—		—		—	
	2nd	—		—		—		—		—	
Argentine Frozen	1st	42	0	42	0	42	0	42	6	42	0
Australian ,, ...	1st	39	6	40	0	39	6	42	0	39	6
New Zealand ,, ...	1st	—		—		—		47	0	—	
LAMB:—											
British	1st	112	0	—		—		99	6	—	
	2nd	102	6	—		—		91	0	—	
New Zealand	1st	59	6	60	6	59	6	72	6	59	6
Australian	1st	57	6	56	0	56	0	58	0	56	0
Argentine	1st	55	6	56	0	55	6	58	0	55	6
PORK:—											
British	1st	80	6	76	0	81	0	69	0	80	0
	2nd	74	0	72	6	73	6	63	6	74	0
Foreign...	1st	71	0	—		74	6	63	6	70	0

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1912, 1913 and 1914.

Weeks ended (in 1914).	Wheat.			Barley.			Oats.		
	1912.	1913	1914	1912	1913.	1914	1912.	1913	1914
	s. d.	s d	s. d.	s d.	s. d.	s. d.	s. d.	s. d	s. d.
Jan 3 ..	33 2	30 5	31 1	33 3	28 6	26 2	20 7	19 10	18 2
,, 10 ...	33 1	30 3	30 11	33 0	28 4	25 11	20 8	19 2	18 4
,, 17 ...	33 4	30 5	31 0	33 3	28 6	26 0	20 11	19 4	18 6
,, 24 ..	33 7	30 11	30 11	33 1	28 10	26 3	21 1	19 4	18 11
,, 31 ...	33 8	31 1	31 1	32 10	28 11	26 6	21 3	20 2	19 1
Feb. 7 ...	34 0	31 0		33 2	28 10		21 4	20 1	
,, 14 ...	34 4	30 9		32 10	29 1		21 7	20 2	
,, 21	34 6	30 11		32 8	28 8		21 9	20 7	
,, 28 ...	34 1	31 0		32 0	28 6		21 6	20 4	
Mar 7 ..	34 1	31 3		31 7	28 5		21 8	20 0	
,, 14 ..	34 0	31 1		31 2	27 11		21 8	20 2	
,, 21 .	34 1	31 1		31 10	28 6		21 9	19 11	
,, 28	34 4	31 3		30 3	27 6		21 8	19 7	
Apl 4 ..	34 10	31 4		30 9	27 0		21 11	19 2	
,, 11 ..	35 4	31 3		30 2	27 8		22 1	19 2	
,, 18 ...	36 7	31 6		29 11	26 11		22 4	18 10	
,, 25 ...	37 10	31 8		30 4	26 7		22 9	19 3	
May 2 .	38 1	32 2		30 2	25 11		23 1	19 6	
,, 9 .	37 11	32 6		31 1	25 9		23 7	19 6	
,, 16 ..	37 8	32 10		31 2	25 4		23 7	19 9	
,, 23 ...	37 2	32 10		31 1	25 3		23 7	19 11	
,, 30 ..	36 10	32 7		30 0	26 1		23 9	20 1	
June 6 ..	36 11	32 10		29 11	26 2		24 0	19 8	
,, 13 ...	37 0	32 8		30 8	24 7		23 10	20 2	
,, 20	37 5	32 8		30 8	23 10		24 0	19 8	
,, 27 .	37 10	32 8		30 2	24 3		23 11	19 1	
July 4 ..	38 2	33 1		31 7	25 2		23 11	21 0	
,, 11 ...	38 3	33 4		30 2	25 10		24 1	19 4	
,, 18	38 10	33 6		30 9	24 9		24 8	20 5	
,, 25 ..	38 9	33 10		30 9	24 1		23 4	20 8	
Aug 1 ..	38 4	34 1		28 6	24 5		22 2	20 3	
,, 8 ...	39 2	34 1		30 7	24 9		22 4	19 0	
,, 15 ...	38 2	34 3		28 3	24 7		21 8	18 7	
,, 22 ...	35 6	33 7		28 1	26 5		20 10	18 8	
,, 29 ...	34 10	32 7		28 6	29 0		20 8	17 10	
Sept. 5 ..	35 1	31 11		29 9	30 11		21 8	17 8	
,, 12 ...	33 5	31 9		29 0	31 5		20 5	18 0	
,, 19 ...	32 7	31 7		29 6	30 9		19 10	17 11	
,, 26 ...	31 7	31 6		29 9	30 1		19 5	17 9	
Oct 3 .	31 8	31 3		29 7	29 9		19 8	17 10	
,, 10	31 10	31 0		30 4	29 1		19 5	17 10	
,, 17 ...	32 2	30 11		30 11	28 8		19 9	17 9	
,, 24 .	33 1	30 7		31 6	28 7		19 10	18 0	
,, 31 .	33 4	30 1		31 10	28 2		20 1	17 9	
Nov 7 ...	33 1	30 0		31 11	28 1		19 11	17 9	
,, 14 ...	32 10	30 1		31 2	27 8		19 9	17 11	
,, 21 ...	32 1	30 4		30 11	27 5		19 11	18 1	
,, 28 ...	31 9	30 9		30 8	27 0		19 8	18 4	
Dec 5 ..	31 0	31 2		29 11	26 8		19 6	18 4	
,, 12 ...	30 8	31 2		29 2	26 5		19 3	18 6	
,, 19 ..	30 7	31 2		28 11	25 11		19 1	18 5	
,, 26 ...	29 10	31 0		28 6	25 10		19 2	18 4	

NOTE.– Returns of purchases by weight or weighed measure are converted to **Imperial Bushels** at the following rates. Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

—		Wheat.		Barley.		Oats.	
		1913	1914	1913.	1914	1913.	1914.
		s. d.	s. d.	s. d.	s d.	s. d	s. d.
France:	January ...	47 2	45 1	30 4	28 4	24 0	22 3
Paris:	January ..	48 9	45 7	31 3	29 5	23 11	21 7
		1912	1913.	1912	1913	1912.	1913.
Belgium:	November ..	35 1	32 3	31 2	26 0	24 3	20 5
	December ..	34 5	32 2	30 7	25 9	23 10	20 8
Berlin:	November ...	44 1	39 10	—	—	25 5	21 8
	December ..	44 0	40 11	—	—	24 1	21 1
Breslau:	November ..	39 11	39 5	32 4* 28 5†	28 3* 25 7†	23 8	21 1
	December ...	38 3	38 9	30 6* 27 6†	28 0* 25 4†	21 11	20 3

* Brewing. † Other

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of January, 1913 and 1914.

—	Wheat.		Barley.		Oats	
	1913	1914.	1913	1914.	1913.	1914.
	s. d.	s. d.	s. d	s. d.	s. d.	s. d.
London	32 2	32 2	25 8	27 6	21 7	20 3
Norwich	31 6	30 7	26 5	25 2	19 10	18 2
Peterborough	27 11	30 6	26 0	25 8	17 2	18 5
Lincoln	28 10	31 4	29 7	26 7	20 0	19 2
Doncaster	28 6	31 1	26 11	24 9	18 11	18 4
Salisbury	31 2	30 4	30 6	26 3	19 5	19 0

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in January, 1914.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.	
	First Quality	Second Quality	First Quality	Second Quality	First Quality	Second Quality
	s. d.	*s. d*	*s. d*	*s. d.*	*s. d.*	*s. d.*
Butter:—	per 12 lb	per 12 lb	per 12 lb	per 12 lb	per 12 lb	per 12 lb
British	16 0	14 0	—	—	17 0	16 0
	per cwt	per cwt.	per cwt	per cwt	per cwt	per cwt.
Irish Creamery—Fresh	—	—	—	—	—	—
„ Factory	106 0	98 0	104 6	97 0	104 0	98 6
Danish... ..	—	—	128 0	123 6	129 0	126 6
French	—	—	—	—	137 0	133 0
Russian	112 0	106 0	—	—	112 6	110 0
Australian	117 0	114 0	115 0	111 6	114 6	112 0
New Zealand ..	122 0	119 6	120 0	118 0	120 0	118 0
Argentine	116 0	114 0	115 0	111 6	113 0	111 0
Cheese:—						
British—						
Cheddar	84 0	74 0	81 6	77 6	87 0	80 0
			120 lb.	120 lb	120 lb.	120 lb.
Cheshire	—	—	84 6	77 6	88 6	84 6
			per cwt	per cwt.	per cwt	per cwt.
Canadian	69 0	67 0	69 0	66 6	69 6	68 0
Bacon:—						
Irish (Green) ...	76 6	73 6	75 0	71 0	79 6	76 0
Canadian (Green sides)	70 0	68 0	68 6	67 0	70 6	68 0
Hams:—						
York (Dried or Smoked)	138 6	129 6	—	—	130 0	120 0
Irish (Dried or Smoked)	—	—	—	—	126 0	120 0
American (Green) (long cut)	70 0	66 0	68 6	66 0	70 0	68 0
Eggs:—	per 120.	per 120.	per 120.	per 120	per 120	per 120
British...	—	—	—	—	16 8	15 5
Irish	14 11	13 6	14 6	13 4	16 4	13 10
Danish...	—	—	15 0	14 0	16 10	14 10
Potatoes:—	per ton	per ton.	per ton.	per ton.	per ton	per ton.
British Queen.. ..	79 6	69 6	—	—	75 0	62 6
Edward VII.	90 0	79 6	55 0	50 0	75 0	63 6
Up-to-Date	76 6	69 6	50 0	46 6	71 6	60 0
Hay:—						
Clover .. .	—	—	90 0	70 0	81 0	74 0
Meadow	—	—	—	—	70 6	63 0

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	JANUARY. 1914.	JANUARY. 1913.
Anthrax:—		
Outbreaks	98	60
Animals attacked	102	71
Foot-and-Mouth Disease:—		
Outbreaks	—	—
Animals attacked	—	—
Glanders (including Farcy):—		
Outbreaks	9	15
Animals attacked ...	26	70
Parasitic Mange:—		
Outbreaks	418	422
Animals attacked	859	1,010
Sheep-Scab:—		
Outbreaks	77	57
Swine Fever:—		
Outbreaks	237	175
Swine Slaughtered as diseased or exposed to infection ...	1,882	2,280
Tuberculosis:—		
Number of Premises notified .	472	—*
Number of bovine animals notified as for slaughter .	494	—*

The Tuberculosis Order came into operation on 1st May, 1913.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE	JANUARY. 1914	JANUARY. 1913.
Anthrax:		
Outbreaks	—	—
Animals attacked	—	—
Foot-and-Mouth Disease:—		
Outbreaks	1	—
Animals attacked .. .	20	—
Glanders (including Farcy):—		
Outbreaks	—	—
Animals attacked	—	—
Parasitic Mange:—		
Outbreaks	17	49
Sheep-Scab:—		
Outbreaks	118	89
Swine Fever:—		
Outbreaks	15	24
Swine Slaughtered as diseased or exposed to infection ...	94	124

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CHICKEN REARING.*

THE demonstration by Mr. F. G. Paynter of his system of producing table poultry which has been carried out during the past season at Haslington Hall, near Crewe, under the auspices of the Board of Agriculture and Fisheries in conjunction with the Cheshire County Council, came to an end in December last.

When the Board arranged with Mr. Paynter to undertake this demonstration, it was decided to inquire whether the Cheshire County Council would be disposed to co-operate with the Board in making suitable provision for it. This the County Council at once agreed to do, and an arrangement was made between the Small Holdings Committee and the Education Committee by which Haslington Hall, with 14 acres of land, of which only 4 acres were devoted to the demonstration, was placed at the disposal of the Board for the purpose. Haslington Hall is situated in the middle of a newly-formed small holdings colony of about 750 acres, let in 19 holdings, and from that point of view it was particularly suitable for the purpose. The field in which the demonstration was conducted, however, was rather heavy, and in this and some other respects it was acknowledged that a more suitable spot might have been found. Haslington Hall, however, was the only vacant house on the County Council Small Holdings, and it had so much to commend it that, in spite of the fact that the particular field (selected on account of its convenience in other ways) was not of the kind most suitable for poultry keeping, the Council's offer was accepted.

The work of hatching and rearing, to which detailed reference is made below, was begun in December, 1912, and by the beginning of the following April the work was in full progress, and the demonstration was thrown open to the public. Representatives of the Press were invited to inspect the demonstration, and the references which appeared in various journals brought

* See also *Journal*, December, 1912, p. 721, and February, 1913, p. 902.

the work to the notice of those likely to be interested in it. In addition, the Cheshire County Council appointed a temporary demonstrator whose chief duty it was to organise visits of small holders and others to Haslington, show them round, and explain the system to them. As a result of these and other means adopted to attract those for whose benefit the demonstration was designed, a large number of people visited Haslington Hall while the work was in progress. A visitors' book was kept, and the names recorded therein number 740. The visits for each month were as follows :—

April	209
May	155
June	157
July	85
August	85
September	40
October	7
November	2
Total	740

This work alone imposed a heavy task upon Mr. Paynter, and upon Mr. Robertson, the demonstrator, particularly as an attempt to restrict the demonstration work to specified days and hours proved unsuccessful. Arrangements were always made beforehand for the visits of poultry societies, educational institutions and similar bodies, but the general public came in twos and threes at any time of day and on any day of the week This fact necessarily interfered considerably with the actual work of poultry keeping, and this naturally exercised an adverse effect on the profit and loss account This point is referred to below.

Among the parties which visited the demonstration were :—

The Agricultural College, Holmes Chapel (twice).
Representatives of Harper-Adams College
The Cheshire Agricultural Society
The Middlewich Farmers' Club
The Derby and District Small Holders' Club
The Moston Small Holders
The Batherton Small Holders
The Haslington Small Holders
The Urmston Poultry Society.
Officers of the Cheshire County Council.
,, ,, Salop ,,
,, ,, Staffs ,,
,, ,, Worcs ,,
,, ,, Lancs ,,
Mr R H Verdin's tenants
Local School Teachers.

As already stated, incubation was commenced in the first week of December, 1912; the first batch of eggs (110) was put in the incubator on December 8th. For some time the work chiefly consisted in the care of the incubators and the preparation of the pens, brooders and appliances. The incubators used were the following:—

2	Cyphers, hot air incubators of	240	egg capacity.
1	,, ,, ,,	390	,,
1	Hearson's ,, ,,	240	,,

The first chickens were hatched towards the end of December, 1912, and from that time onwards the process of rearing continued till the end of the demonstration. An incubator, containing 240 eggs, was started each week, except every fourth week, when the largest incubator, containing 390 eggs, was used The eggs were all purchased and were obtained from various sources where the stock was known to be suitable. The number of eggs purchased and incubated and the resulting number of chickens hatched is shown in Table I. From this table it will be seen that the percentage of chickens hatched to eggs purchased was never more than 54 per cent., and the average is only 41 per cent. If, however, allowance is made for the number of infertile and broken eggs, the percentage rises to an average of 51 per cent. Each hatch thus consisted of about 120 chickens, from approximately 240 eggs. This relatively small proportion of chickens to eggs was partly due to shaking in transit, and it is probable that better results would have been obtained if reliable eggs of suitable kinds could have been purchased locally. Mr. Paynter endeavoured to arrange for a local supply, even presenting well-bred cockerels to the small holdings tenants who had suitable hens, and undertaking to purchase eggs for sitting at 1*s.* per dozen above the current local price, but his efforts in this direction were not attended with much success.

From the incubators the chickens were moved to the brooders. For the first week each batch was housed in two brooders under cover close at hand; at the end of a week the chicks were moved to larger brooders in the rearing field. These larger brooders they used for six weeks. Half-way through this period, during which time they grew rapidly, the batch, consisting on the average of 120 chickens, hitherto housed in two brooders, was now divided amongst three brooders, each of which thus contained about 40 chickens. This division into batches of forty continued during the time they remained in the brooders.

When the chickens were seven weeks old, they were removed to larger wire runs (100 yards by 10 yards) and housed in what are known as Sussex arks. The chief advantage claimed for this type of poultry house is that adequate ventilation is secured; the arks are also cheap, light and portable. The provision of slatted floors with a movable floor below enables the manure to be collected easily and removed for storage. Sixty chickens were placed in each ark, and at the age of 12 weeks the number per ark was reduced to 40 by transferring 20 from each ark to other arks placed in adjacent runs.

At about the end of 16 weeks from the date of hatching each batch of chickens was ready for sale. The plan adopted by Mr. Paynter for disposing of them was to contract beforehand for the sale of the whole of his output to a poulterer near London at the following prices :—

	s.	d.	
During the month of April	3	9	each.
,, ,, May . ..	3	6	,,
,, ,, June ..	3	3	,,
,, ,, July ..	3	0	,,
,, ,, August ..	2	9	,,
,, ,, September ..	2	6	,,

The chickens were sent away alive in crates containing 12 each. The purchaser paid carriage. This arrangement is satisfactory from the point of view of both producer and purchaser, because not only is the producer saved the trouble and expense of killing, plucking and dressing the birds, but the purchaser's poultryman is able conveniently to devote time in the afternoons to preparing the fowls for sale next day. Table II. shows the number of fowls reared and sold and the prices obtained for them.

The following statement contains a summary of the food consumed and of its cost :—

		£	s	d.
3,437 lb.	Chick feed	24	10	1
7,071 ,,	Biscuit Meal .. .	40	5	8
711	Oatmeal	5	3	1
389	Rice	3	2	3
1,899	Bran	6	18	9
2,862	Meat and Fish Meal ..	24	9	3
4,475	Barley Meal	19	18	4
21,210	Sharps	77	6	7
18,985	Wheat with 10 per cent of Maize	68	3	5
		269	17	5
	Grit	5	10	0
	Total food bill	£275	7	5

TABLE I.—STATEMENT OF EGGS INCUBATED AND NUMBERS OF CHICKENS HATCHED.

Date	No of Hatch	Bought	Broken	Infertile	Not hatched	Chicks	Cost of Eggs. £ s d.	Percentage hatched on total number of eggs incubated.	Percentage of chickens hatched after allowing for broken and infertile eggs.
December 8th ..	1	110	4	14	54	38	1 7 6	34	41
" 15th .. .	2	254	5	23	118	108	2 16 3	42	48
" 22nd . .	3	344	4	56	119	165	3 16 7	48	58
" 29th . ..	4	274	7	46	79	142	2 14 5	52	64
January 5th . ..	5	237	—	54	99	84	2 9 4	35	46
" 12th	6	261	8	55	106	92	2 13 11	35	46
" 19th . .	7	312	20	79	108	105	2 19 3	34	49
" 26th . ..	8	404	17	96	156	135	3 18 9	33	46
February 2nd .	9	325	15	73	133	104	3 2 8	32	44
" 9th .	10	169	1	17	59	92	1 15 2	54	60
" 16th	11	418	7	66	175	170	3 12 11	40	49
" 23rd .	12	296	12	43	121	120	3 1 8	41	50
March 2nd	13	355	4	58	173	120	3 1 10	34	41
" 9th .	14	259	8	40	89	122	2 3 0	47	58
" 16th	15	405	11	37	167	190	3 7 6	47	53
" 23rd . .	16	300	5	31	124	140	2 10 0	47	53
" 30th ..	17	432	4	77	224	127	2 10 7	29	36
April 7th .	18	240	—	31	91	118	1 7 6	49	56
" 14th . .	19	389	37	51	133	168	2 3 10	43	56
" 20th . .	20	240	20	15	98	107	1 10 0	45	52
" 26th .	21	347	22	54	103	168	2 3 5	48	62
May 4th . ..	22	264	12	36	89	127	1 13 0	48	59
" 11th . .	23	360	7	66	117	170	2 5 0	47	59
" 18th	24	360	8	34	153	165	2 5 0	46	52
" 25th .	25	360	15	115	115	115	2 5 0	32	50
June 1st .	26	360	9	79	116	156	2 5 0	43	57
" 9th ..	27	490	24	114	227	125	2 14 8	26	36
" 16th .. .	28	466	4	97	170	195	2 16 1	42	53
" 24th .. .	29	240	4	49	97	90	1 10 0	38	48
" 29th . ..	30	626	—	84	272	270	3 17 0	43	50
		9,897	294	1 690	3,885	4,028	76 16 10	Average .. 41	Average .. 51
				Day-old	chickens bought,	135 .	3 3 5		
							£80 0 3		

Average cost of eggs per chicken hatched, $4\frac{1}{4}d$.

A summary of the essential details of Mr. Paynter's system was printed and distributed to those who came to see the demonstration, as it was felt that if some definite record of the kind was available it would aid visitors in understanding the object of the demonstration.

The profit and loss account (Table III.) was prepared for the Board by Mr. J. Thornely, Chartered Accountant, Chester. By it the net profit on the year's working is shown to be £55 1*s.* 2*d.*; but in arriving at this figure, certain expenses have been included which a small holder carrying on the work would probably not have incurred. Thus with regard to the item of £19 19*s.* 7*d.* for carrying and carting, Mr. Paynter had to pay for carting chickens, poultry food and other things between Haslington and Crewe, whereas a small holder would doubtless do this work himself. Similarly, expense for wages and work of an experimental nature would not have been incurred by a small holder, while the balance of the amount paid for oil (£3 16*s* 1*d.*) represents the estimated value of the oil used for domestic purposes. On the credit side of the account there is little doubt that the receipts for the sale of the 4 tons of collected manure should have been larger, and no value is placed on the manure distributed in the runs. It is also worthy of note that the average weight of the birds when sold was slightly over 4 lb.*

In this connection it should also be mentioned that there was a considerable loss, the extent of which could not be ascertained, from depredations of stoats, and from other unavoidable causes.

If the items for wages, experimental work, and oil used for domestic purposes are omitted, as it is suggested they may properly be, the net profit is shown to be £88 12*s.* 10*d.*

There are several reasons why this profit and loss account cannot fairly be regarded as a true measure of the success of the system and of its working. The actual work of rearing poultry was seriously interfered with by the main purpose of the demonstration, viz., the reception of so large a number of visitors. Apart from the fact that a great deal of time was necessarily devoted to showing them round, it is a well-known fact that growing chickens will not thrive properly if they are constantly disturbed by the presence of strangers. In this case whatever effect was produced could not be avoided, because the demonstration was purposely conducted for the

* See Table II.

TABLE II.—STATEMENT OF SALES.

Date		No of Birds	Weight	Value.		
			lb	£	s	d
April	12th	37	148	6	18	7
,,	19th . ..	95	356	17	16	3
,,	26th . .	72	270	12	18	0
May	13th	88	332	15	8	0
,,	20th . ..	48	192	8	8	0
,,	27th	96	384	16	16	0
June	3rd . .	96	384	16	4	0
,,	10th	132	528	21	9	0
,,	17th	89	346	14	9	3
,,	24th . ..	111	444	18	0	9
July	2nd ..	110	440	17	5	0
,,	8th . ..	111	444	16	13	0
,,	15th . ..	119	530	17	18	6
,,	22nd	108	486	17	4	0
,,	29th	164	658	25	4	0
August	2nd ..	104	416	14	19	0
,,	9th . .	88	352	12	0	4
,,	16th .	106	424	14	11	9
,,	23rd .	255	1,142	34	14	2
,,	30th . ..	51	243	6	10	0
September	6th . ..	34	153	4	4	9
,,	13th . .	140	560	18	8	0
,,	20th .	56	224	7	0	0
,,	27th .	54	216	6	15	0
October	4th ..	166	664	20	16	6
,,	11th . ..	106	424	13	5	0
,,	18th . ..	98	392	12	5	0
,,	25th .. .	151	604	18	17	6
November	1st .	78	312	9	15	0
,,	8th . .	73	258	9	2	6
,,	15th	102	408	12	15	0
,,	22nd .	74	296	9	5	0
,,	29th . .	56	224	7	0	0
December	6th . .	93	372	13	12	6
,,	13th .. .	107	342	7	18	9
Total		3,471	13,968	496	8	1

Average weight of chickens when sold .. .. 4.024 lb
,, price received per pound .. .. 8½*d*.

TABLE III.—POULTRY DEMONSTRATION, HASLINGTON HALL, CREWE.

Profit and Loss Account for year ended 30th November, 1913.

Dr.		£ s. d.			Cr. £ s. d.
1913 Nov 30th	*To* Eggs purchased	76 0 5	1913. Nov. 30th	*By* Chickens sold 3,471	496 8 1
	„ Chickens	4 1 1		„ Manure sold	2 10 0
	„ Oil used (three-fourths of amount paid)	11 8 3		„ Eggs sold (from Pullets reared)	1 5 10
	„ Food purchased	275 7 5			
	„ Peat Moss	1 4 0			
	„ Medicine	0 13 3			
	„ General Expenses	1 13 5			
	„ Rent of 4 acres at 45*s* per acre	9 0 0			
	„ Interest on Capital, say on £300 at 5 per cent	15 0 0			
	„ Depreciation of Plant on £219 3*s* at $7\frac{1}{2}$ per cent	16 8 9			
	„ Cheque books	10 0			
	„ Bank Commission	0 4 6			
	Profit carried down	88 12 10			
		£500 3 11			£500 3 11
1913 Nov. 30th	*To* Carriage on Eggs and Carting	19 19 7	1913 Nov. 30th	*By* Profit brought down	88 12 10
	„ Wages	2 16 0			
	„ Experimental	7 0 0			
	„ Oil (balance of amount paid)	3 16 1			
	Net profit	55 1 2			
		£88 12 10			£88 12 10

I have drawn up the above Account of the Poultry demonstration held at Haslington Hall, Crewe, for the twelve months ended November 30th, 1913, and have examined same with the books and vouchers kept by Mr Paynter, and, according to the information and explanations given me, certify the same as correct.

January 9th, 1914.

(Signed) J. THORNELY,
Chartered Accountant
Chester.

information of people who could only derive the desired benefit from it by inspection. But the very success of the work from the demonstration point of view had to be paid for, to some extent at least, by a financial loss. Moreover, as the Cheshire County Council undertook the work with an educational object, the preponderance deliberately given by Mr. Paynter to the demonstrative rather than to the financial aspect was fully justified, the purpose of the demonstration being not to attain the greatest possible financial return, but to illustrate to the public how to rear chickens in a way adapted to the needs of the small holder, and to show in full working order methods and appliances which are capable of producing practical and remunerative results.

The Board desire to give full acknowledgment to the assistance given to the demonstration by the Cheshire County Council, and to the unremitting care and attention bestowed upon the work for so many weeks without a break by Mr. Paynter himself.

During the current year Mr. Paynter is conducting a similar demonstration in Cambridgeshire.

AMERICAN GOOSEBERRY MILDEW:

SPRAYING EXPERIMENTS AGAINST *SPHÆROTHECA MORS-UVÆ*. TOGETHER WITH SOME OBSERVATIONS ON THE LIFE-HISTORY OF THIS MILDEW.

E. S. SALMON, F.L.S.,

Mycologist, South-Eastern Agricultural College, Wye.

IN previous issues of this *Journal** the writer has given the results of spraying experiments against the American gooseberry mildew, which have been carried out during past seasons either at Wye College, or on fruit farms in Kent. In this article are described spraying experiments which were carried out during 1913 on farms at three centres in Kent. Further, some new or little-known facts, likely to prove of practical importance, are here recorded.

1.—*Spraying Experiments.*

The spraying experiments in 1913 had two main objects: (1) to ascertain at what strength and to what extent lime-sulphur can be used on commercial varieties of gooseberries without causing injury; and (2) to compare the fungicidal action against the mildew of "lime-sulphur" and the "liver-of-sulphur" solution. The bushes used, situated

* May, 1912, and March, 1913.

in large commercial plantations on fruit-farms at three centres (Rodmersham, Boughton-under-Blean, and Mereworth), were freely offered for experimentation in any direction. In order to ensure thorough and uniform spraying, the work of mixing and applying the various washes was done by Mr. R. G. Hatton and the writer, Mr. Hatton (now on the staff of Wye College) doing all the actual spraying, as well as assisting in making observations. The Vermorel " Eclair étamé " knapsack sprayer was used, with a nozzle giving a very fine " misty " spray.

The spraying experiments are described under the different centres and the name of the variety of gooseberry.

Centre: RODMERSHAM.—*Plot 1*—*Yellow Rough* (*Golden Drop*)—The bushes were eight years old, in a plantation shaded by mature fruit trees

May 12.	(1)	6 bushes sprayed with lime-sulphur	1 01 sp gr
	(2)	5 ,, ,, ,, ,,	1 005 ,,
	(3)	25 ,, ,, ,, iron-sulphide	(Oregon formula)*

On *May 13th*, no appreciable injury was visible, but there were slight indications of leaf-fall beginning on the iron-sulphide plot, these bushes were, therefore, not sprayed again

May 13	(1) and (2) as before		
	(4)	8 bushes sprayed with lime-sulphur	1 01 sp gr
	(5)	9 ,, ,, ,,	1 005 ,,
	(6)	10 ,, ,, liver-of-sulphur solution	1 oz. to 3 gall water

On *May 26th*, the following injury was observed—On (1) and (2) very severe leaf-fall had taken place, and there was a characteristic odour of decaying vegetation from the sprayed leaves still remaining on the bushes The amount of injury done was sufficient to preclude the use of lime-sulphur (3) The bushes showed serious leaf-fall; from many of them came the characteristic sickly-sweet or almost pungent smell of leaves injured and slowly dying as the result of the spraying. In view of the fact that the iron-sulphide spray is stated to be quite harmless to the foliage of the apple and rose, the doubt arose whether the wash used (although made strictly according to the formula) had been washed absolutely free of lime-sulphur (see footnote, below). To test this point, sprayings were now made with the iron-sulphide wash proved by chemical tests to be absolutely free from lime-sulphur (see below May 26th (9) and (10))

* This wash was made on the following formula, given by Professor P. J. O'Gara, in his Leaflet " Lime-Sulphur " (Rogue River Valley, Medford, Oregon, 1911) " Iron-sulphate, 1 lb Lime-sulphur (32 degrees Beaume test), 1 qt. Water 10 gall. Dissolve the iron-sulphate in about 5 gall. of water and add the quart of lime-sulphur, stirring well. Let the black precipitate settle for a few hours and pour off the liquid, keeping the precipitate. Then add 5 gall of water, stir thoroughly and let settle again. Pour off the liquid as before This process is called washing, and is necessary in order to get rid of the excess lime-sulphur, which would burn tender foliage. Repeat the washing until the water is no longer yellow. The black " muck " should be diluted to 10 gall. and sprayed with good agitation . . . This is the standard [summer] spray for apple and rose mildew for this district." This spray did not spread well, though the leaves of the bushes, when dry, were fairly well covered with large blotches.

(4) The bushes now showed that marked leaf-fall had been caused. (This had not taken place, it may be noted, by May 20th). (5) The bushes showed leaf-fall just commencing. (6) No leaf-fall had taken place, but there was a more or less distinct yellowing of the older leaves, caused by the action of the spray. Since, on the plots (1), (2), (4) and (5), the same serious injury was being caused by the lime-sulphur spray as had been observed in previous seasons,* it was decided to discontinue the use of this spray

May 26. (6) as before

(7) 8 bushes sprayed with liver-of-sulphur solution, 1 oz to 3 gall water

(8) 8 bushes sprayed with liver-of-sulphur solution, 2 oz to 3 gall water

(9) 8 bushes sprayed with iron-sulphide

(10) 8 bushes sprayed with iron-sulphide, half-strength.

On *June 6th*, all the sprayed bushes showed such severe defoliation that it was useless to continue using any of the washes The chemically-tested iron-sulphide, (9) and (10), had produced as severe injury as that originally used

All the bushes where "liver-of-sulphur" had been used were by now equally damaged.

At this date, also, it was apparent that the sprayings had not prevented the mildew from attacking the fruit of the bushes on many of the plots, a number of berries were severely affected, more particularly on the iron-sulphide plots

The high degree of susceptibility which is shown by Yellow Rough to injury from the effects of sulphur washes became apparent under the following circumstances A plantation of May Duke was sprayed with lime sulphur, a short time afterwards it was observed that some bushes of Yellow Rough which adjoined the sprayed May Dukes, although they had been untouched by the spray, had dropped a considerable number of their leaves This injury extended to about five rows of the Yellow Rough It seemed clear that in this case the gas (either sulphuretted hydrogen or sulphur dioxide), which is given off from the lime-sulphur wash when exposed to the air, was responsible for this leaf fall To determine this point some lime-sulphur was sprayed over the soil surrounding some bushes of Yellow Rough, care being taken that none of the spray touched the bushes After a few days considerable leaf-fall resulted

The Kent County Council Inspectors have informed me that "flowers-of-sulphur" dusted over bushes of Yellow Rough causes severe defoliation

All the experiments show clearly that it is unsafe to use sulphur in any form on Yellow Rough, as severe defoliation results The same is the case when the iron-sulphide wash is used.

Plot 2 —Freedom —The bushes were 8 years old, and partly shaded under fruit trees

May 2	(1)	6 bushes sprayed with lime-sulphur,	1 01 sp gr.
	(2)	6 ,, ,, ,,	1 005 ,,
May 13.	(1) & (2) as before.		
	(3)	10 bushes sprayed with lime-sulphur,	1 01 ,,
May 26.	(1) and (2) as before.		
	(4)	8 bushes sprayed with lime-sulphur,	1 01 ,,

* *Journal*, March, 1913, p. 1000.

On *June 6th* the bushes (1) and (2) which had been sprayed three times with lime-sulphur showed marked leaf-fall. No leaf-fall or other injury appeared on the bushes (3) sprayed once with lime-sulphur on May 13th; while slight, but not serious leaf-fall occurred on the bushes (4) sprayed once with the same wash on May 26th.

It would appear that Freedom may safely be sprayed with lime-sulphur at "full strength" once or twice in May or earlier, but more frequent applications or spraying later in the season will cause a certain amount of leaf-fall

Plot 3—Howard's Lancer—The bushes were 10 years old, and situated in the open

May 2. (1) 5 bushes sprayed with lime-sulphur, 1 01 sp. gr.
May 13 (1) as before
June 12 (1) ,,

No injury resulted at any time, and hence it seems safe to conclude that Howard's Lancer may safely be sprayed three times successively with "full strength" lime-sulphur during May and June

Plot 4—May Duke—The bushes were 12 years old, and growing in an open position

May 13 (1) 11 bushes were sprayed with lime-sulphur, 1 01 sp gr
(2) 6 bushes were sprayed with liver-of-sulphur solution, 1 oz to 3 gall water
May 26. (1) and (2) as before
June 6. (1) and (2) ,,
June 12 (1) and (2) ,,
June 23. (1) and (2) ,,

Beyond the falling of a few leaves from the bushes sprayed with liver-of-sulphur, no injury resulted It can be concluded, therefore, that May Duke may safely be sprayed five times successively during May and June with either lime-sulphur or liver-of-sulphur solution

Plot 5—Gunner's Seedling—The bushes were 8 years old, and partly shaded under fruit trees

May 2 (1) 14 bushes sprayed with lime-sulphur, 1 01 sp gr.
(2) 10 ,, ,, ,, 1 005 ,,
May 13 (1), (2), (3) 50 bushes (including (1) and (2)) were sprayed with lime-sulphur, 1 01 sp gr.
(4) 11 bushes were sprayed with liver-of-sulphur solution, 1 oz. to 3 gall. water
May 26 (1), (2), (3) as before (a light spraying only, to cover the new shoots).
(4) as before.
June 6 (5) 25 bushes sprayed with lime-sulphur, 1 01 sp gr.
(6) 11 ,, ,, liver-of-sulphur solution 2 oz to 3 gall
June 12 (1), (2), (3) and (4) as before

No injury whatever resulted from any of the sprayings Gunner's Seedling may safely be sprayed four times during May and June with "full strength" lime-sulphur

Plot 6—Cousin's Seedling (Sandwich Yellow)—The bushes in one part of the plantation were eight years old (called "old" below), and more or less shaded under fruit trees; in the other part they were four to six years old (called "young" below), and situated in the open.

May 2. (1) 12 "old" bushes sprayed with lime-sulphur, 1 01 sp. gr.
(2) 10 "old" bushes sprayed with lime-sulphur, 1.005 sp. gr.
(3) 20 "young" bushes sprayed with lime-sulphur, 1 01 sp. gr.

On May 13 no injury was observable.

May 13. (1), (2), (4) 50 "old" bushes (which included (1) and (2)) sprayed with lime-sulphur, 1.01 sp. gr.
(3), (5) 53 "young" bushes (which included (3)), sprayed with lime-sulphur, 1 01 sp gr.
(6) 10 "old" bushes sprayed with liver-of-sulphur solution, 1 oz to 3 gall. water
(7) 20 "young" bushes sprayed with liver-of-sulphur solution, 1 oz. to 3 gall. water

On *May 26th* no injury was observable on the "old" bushes, in the case of the "young" bushes sprayed with lime-sulphur (3), (5), the leaves showed a slight but distinct scorching of many of the leaves, which were brown at the tips and edges, but no leaf-fall resulted and the injury done was not serious and of no practical importance (The same scorching effect was noticeable on the adjoining part of the plantation—consisting of bushes of the same variety and age—where spraying had been done with a power sprayer, using lime-sulphur, 1.01 sp gr).

May 26 (3), (5), (6) and (7) as before
(8) 10 "old" bushes sprayed with liver-of-sulphur solution, 1 oz to 3 gall. water
(9) 7 "old" bushes sprayed with liver-of-sulphur solution, 2 oz to 3 gall water

June 6. (10) 15 "old" bushes sprayed with liver-of-sulphur solution, 2 oz to 3 gall. water.
(11) 37 "old" bushes sprayed with lime-sulphur, 1 01 sp gr

June 12 (1), (2), (3), (4), (5), (6), (8), (9), and (10) as before.
June 23 (1), (2), (3), (4), (5), and (10) as before.
July 12 (1), (2), (3), (4) and (5) as before.

The results of the sprayings as regards injury may first be noted, and then, secondly, the effect of the sprayings in dealing with an outbreak of the mildew that occurred in this plantation The experiments demonstrated that lime-sulphur at "full strength" can be used with perfect safety on Cousins' Seedling, a variety not hitherto experimented with. Successive sprayings repeated five times on "old" bushes and six times on "young" bushes from May to July caused no appreciable injury to the leaves or shoots This is a fact likely to prove of considerable practical importance in the future treatment (against mildew) of this very valuable late dessert gooseberry. The liver-of-sulphur solution, at 1 oz to 3 gall. water, caused no appreciable amount of scorching, and no leaf-fall; but the same solution at the rate of 2 oz to 3 gall. of water, even when applied in cool weather, caused an amount of injury which clearly indicated that the danger-point was reached. As, however, the liver-of-sulphur solution showed itself under the relative conditions to be quite ineffectual in stopping the spread of the mildew, the point is of less practical importance.

On *May 26th*, the outbreak of mildew occurred in the plantation On that day, the mildew was found in the " powdery " summer-stage,* curling the young leaves of some shoots growing from four bushes of Cousins' Seedling which had been cut down to the ground in the summer of 1912 because they were at that time virulently attacked by the mildew In one case, even at this early date—May 26th—the spawn (*mycelium*) of the mildew on the surface of one of the shoots was turning brown, *i e*, beginning to form the " winter-stage " On the discovery of the outbreak, the four bushes were very heavily sprayed with lime-sulphur, 1 01 sp gr On June 6th all the original patches of mildew on the four bushes were seen to be stopped or killed, and no fresh infections on these bushes were to be found The spray had slightly scorched the tips of the young leaves, but no appreciable injury was caused By this date (June 6th) the mildew had appeared on 19 more bushes of Cousins' Seedling On these bushes the mildew was in vigorous white powdery patches, both on the berries and on the leaves of the shoots (which were curling under the attack) and, also, it had developed in many cases the brown winter-stage both on the berries and on the surface of the shoots The infection of these 19 bushes had certainly taken place between May 26th and June 6th The general condition of these infected bushes and the spray applied to them on *June 6th* were as follows —

Bush 5 Severe attack, summer- and winter-stage on tips of most shoots
,, 6 Slight attack, just starting; summer-stage only on a few tips
,, 7 Severe, summer-stage on most tips
,, 8 Slight, summer-stage on a few tips
,, 9 Severe, summer- and winter-stage on many tips
Bushes 10, 11 Slight, summer-stage just beginning

Bushes 5 to 11 were given a heavy spraying (the bushes being drenched) with liver-of-sulphur solution, 2 oz to 3 gall water

Bush 12 Moderate attack, summer- and winter-stages on several shoots
Bushes 13, 14 Slight attack, summer-stage just beginning
,, 15, 16 Severe attack, most tips affected with big patches of summer-stage
Bush 17 Slight attack, summer-stage only
,, 18 Severe attack, a little winter-stage as well as summer-stage on most of the shoots.
Bushes 19, 20 Slight attack, summer-stage on shoots and a number of berries
,, 21, 22, 23 Slight attack, summer-stage on shoots only.

On *June 12th*, the seven bushes (Nos 5 to 11) which had been sprayed heavily on June 6th with liver-of-sulphur solution were examined, and it was found that *the spread of the mildew had not been checked on them*, the disease being quite as bad or even worse, with numerous white, powdery patches of the summer-stage, and extended patches of the brown winter-stage The 12 bushes (Nos. 12 to 23) which had been sprayed with lime-sulphur were in a much healthier

* A fully illustrated Leaflet giving the life-history of the American Gooseberry Mildew can be obtained free on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

condition; there were now no powdery patches of the summer-stage, though patches of winter-stage were still to be seen, and it was clear that the spread of the disease was greatly checked.

At this date the seven bushes (Nos 5 to 11) were again sprayed with the liver-of-sulphur solution; the lime-sulphured bushes (Nos 12 to 23), being still well-covered, did not at this time receive another spraying.

On *June 23rd*, another examination was made of the mildewed bushes in this plantation Taking first the four bushes which had been cut down in 1912, the shoots from these had by now produced about 6 in of fresh growth, in most cases these had become attacked by mildew The condition of the bushes was as follows —Bush (1), a good deal of "summer-stage" on the young shoots; (2) and (3), tips badly infested with both the white "summer-stage" and the brown "winter-stage"; (4), no fresh infections These bushes were now sprayed again with lime-sulphur.

With regard to the bushes sprayed with the liver-of-sulphur solution, their condition was as follows —

Bush (5). *A mass of disease;* the mycelium had developed extensively and covered the tips of the greater number of the shoots with continuous brown patches ½ in. to 3 in. long, the fruit was also badly attacked, about 75 per cent of the berries being more or less completely enveloped in the brown winter-stage.

Bush (6). Mildew still present in both summer- and winter-stages on the tips of most shoots

Bushes (7) and (8). Tips of shoots with abundant powdery summer-stage; disease in very infectious stage and obviously on the increase

Bush (9). Disease severe, on shoots and berries in summer- and winter-stages

Bushes (10) and (11). Most of the tips of the shoots smothered with the summer-stage, and about 50 per cent. of the berries with large patches of the winter-stage

It was perfectly clear that, under the conditions prevailing, the liver-of-sulphur solution was powerless to check the spread of the mildew in any way The facts are as follows.—The bushes had been kept under careful observation through May and June, and it is certain that no mildew was present until June 6th, when a very few spots of the white summer-stage were found All the bushes were immediately drenched with liver-of-sulphur solution at the strength of 2 oz. to 3 gall of water—clearly the strongest solution possible, since at this strength the tips of the youngest shoots were turned brown and killed, and the edges of the young leaves were scorched and shrivelled Another drenching with this wash was given on June 12th—less than a week after, yet the disease was not appreciably checked in any way, many of the bushes on June 23rd being literally smothered with disease on shoots and berries In the case of some of the bushes, notably bushes (5), (10) and (11), the fact that all or nearly all the berries on the lower branches became so rapidly and severely attacked strongly suggests that at that time infections were occurring plentifully from "winter-spores" (*ascospores*) arising from fruit-bodies (*perithecia*) which had wintered on or in the soil under or round the bushes

The bushes which had received lime-sulphur were found to be in the following condition :—

Bush (12). Small patches of the winter-stage on a few shoots (probably at the places where it existed at the time of spraying); two tips with powdery summer-stage; disease not severe.

Bush (13). A trace only of mildew on a very few tips.

Bush (14). A few tips with the mildew in the summer- and winter-stages, a good number (about 25 per cent.) of the berries more or less completely enveloped in the brown winter-stage In many cases these berries had been well sprayed with the lime-sulphur, but had become more or less covered with the winter-stage. The spawn (*mycelium*) of the winter-stage of the mildew could be seen growing and extending over the "blotches" of the dried lime-sulphur wash.

Bushes (15), (16) and (17). From 10 to 25 per cent of the berries affected with the winter-stage; only a few tips showing the mildew (in summer-stage).

Bush (18). Tips of shoots free from mildew; a little winter-stage on a few berries.

Bush (19). Two tips apparently just infected—white and powdery.

Bush (20). Shoots all healthy.

Bush (21). A mere trace of the disease

Bush (22). Many (about 40 per cent) of the berries and also of the shoots with patches of the winter-stage; a few tips showing the summer-stage

Bush (23). Fresh infections on many of the tips, patches of the winter-stage on the older parts of several shoots.

Although these bushes which had been sprayed once with lime-sulphur had certainly considerably less mildew on them than those bushes (Nos. 5 to 11) which had been sprayed twice with the liver-of-sulphur solution, it was clear that the lime-sulphur wash had had no deterrent effect on the growth of the mycelium of the winter-stage. Further, either the spraying on June 6th had not killed all the summer-stage present, or more probably, the young growth of the bushes had become reinfected by air-borne spores in the interval between June 6th and June 23rd. As in the case of the bushes, noted above, there were indications (*e g.*, with respect to bushes (14), (15), (16), (17), and (22)) that the berries had all been heavily infected about the same time, very possibly from winter-spores arising from the soil—in which case spraying would be of little or no use

It may be noted, further, that the 15 bushes (see p. 1061 (10)) which had been sprayed heavily with liver-of-sulphur solution on June 6th, June 12th, and June 23rd, were on July 12th smothered with mildew at the ends of the shoots.

In 1912 many of the bushes of Cousins' Seedling suffered from a severe attack of the mildew, and the berries became very badly diseased. These diseased berries were not removed until August when the crop was ripe, by which time it is probable that considerable numbers of perithecia had fallen to the ground. The sudden and severe attack on the berries in 1913 (noted above) may perhaps be attributable to winter-spores arising from the ground in June, 1913, in consequence of the infection of the soil in August, 1912.

Cousins' Seedling appears to be specially liable to severe attacks of the mildew, both on the shoots and on the berries. Owing to its habit of growth, viz, the horizontal branches keeping low near the ground, the variety is difficult to spray, unless specially pruned to encourage an upward growth of the branches In view of the great damage done by the mildew to this variety, such a system of pruning should always be adopted When the berries are attacked early, *the entire crop may be destroyed* The young berries often become completely covered with the brown scurf-like mycelium and are prevented from swelling (see photograph of the upper berries in Fig 1)

In a one-acre plantation of Cousins' Seedling in East Kent, visited last August, there was scarcely one berry to be found which was not diseased, the great majority of the berries over the whole plantation did not attain more than a quarter of their proper size Not a berry was picked for market off the whole area. It is extremely important that all diseased berries of Cousins' Seedling and other late varieties should be picked and destroyed before the brown winter-stage has developed on them

Plot 7 —Berry's Early —The bushes were about 10 years old and shaded under mature fruit-trees.

May 13	(1)	6 bushes sprayed with lime-sulphur, 1 01 sp gr.
	(2)	6 ,, ,, ,, ,, 1 005 ,,
	(3)	8 ,, ,, liver-of-sulphur solution, 1 oz to 3 gall. of water
May 26	(1), (2) and (3)	as before
	(4)	10 bushes sprayed with lime-sulphur, 1 01 sp gr
	(5)	7 ,, ,, ,, ,, 1 005 ,,
	(6)	10 ,, ,, liver-of-sulphur solution, 1 oz to 3 gall of water
	(7)	10 bushes sprayed with liver-of-sulphur solution, 2 oz to 3 gall of water
	(8)	7 bushes sprayed with iron-sulphide "half-strength"
June 12	(1), (2), (3), (4), (5), (6), and (7)	as before
	(9)	4 bushes sprayed with liver-of-sulphur solution, 1 oz to 3 gall of water
	(10)	4 bushes sprayed with liver-of-sulphur solution, 2 oz to 3 gall of water
June 23	(1), (2), (9), and (10)	as before
July 12	(1) and (2)	as before.
July 28	(1) and (2)	as before

No injury resulted in any case, even on the bushes (1) and (2) which received six thorough sprayings with lime-sulphur

The effect of the spraying on the mildew may now be noted. By July 12th a severe attack of mildew was in evidence in the plantation (about $1\frac{1}{2}$ acres) of Berry's Early in which Plot 7 was situated. The mildew occurred in its summer- and winter-stages practically all over the plantation, being particularly bad on the bushes adjoining the sprayed plot—some of them had practically every tip badly attacked. An examination of the sprayed bushes at this date gave the following results :—

(1). The 6 bushes which had been sprayed four times with "full strength" lime-sulphur were quite free from mildew.

(2). The 6 bushes sprayed four times with "half-strength" lime-sulphur showed the mildew just appearing on the tips of several shoots.

(4) and (5). These bushes sprayed twice with lime-sulphur (last spraying June 12th) were just beginning to be attacked at the tips.

(3). These bushes sprayed three times with liver-of-sulphur solution were very badly infected for a considerable length at the ends of most of the shoots

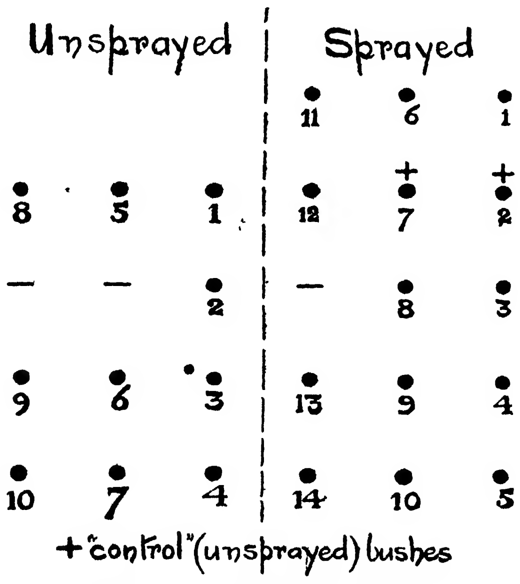
(6). The 10 bushes sprayed twice with the liver-of-sulphur solution were now all badly infected on most of the shoots

(7). These 10 bushes sprayed with the stronger solution of liver-of-sulphur were similarly affected

(8). The bushes were all badly infected.

(9) and (10). The two sprayings with liver-of-sulphur on June 12th and June 23rd had not protected the bushes from infection, most of the tips now showing the disease in a virulent and infectious condition

The first interesting point was the superiority shown (as in Plot 6 of Cousins' Seedling, p. 1064) by lime-sulphur in keeping off the mildew, in comparison with the liver-of-sulphur solutions. The second point of interest was the sudden appearance of the mildew in such virulence over so large an area; on June 23rd there was no sign of the mildew over the whole plantation of Berry's Early, but by July 12th the mildew was general over the whole piece (with the exception of plots (1), (2), (4), and (5)) not only in the summer-stage but equally plentifully in the winter-stage There was every indication of the bushes having been generally infected by a profusion of summer-spores carried by the



Plan showing Bushes in Plot 7.

wind into the plantation Could this have been anticipated, thorough spraying with lime-sulphur on some date between June 23rd and July 12th would have saved this particular plantation from the severity of the attack, if it had not altogether prevented the disease.

As the bushes (1) and (2) were, owing to the previous lime-sulphur sprayings, free or almost free from the mildew, these were sprayed again on July 12th. On July 28th the bushes in (1) and (2), which had been

FIG 1 —Gooseberries (*Cousins' Seedling* all but one attacked by the American Gooseberry Mildew The healthy berry shows the size to which the others should have grown if healthy The smaller berries are completely invested with the *mycelium*.

FIG 2 – End of a goosberry shoot (*Berry's Early*) severely attacked by the American Gooseberry Mildew The uppermost leaves have been so severely attacked when young that they have not grown out. These young, distorted leaves are completely covered with the *mycelium* of the winter-stage of the mildew, which occurs also on the leaf-stalks and on the surface of the stem.

sprayed respectively with lime-sulphur at " full " and " half-strength," showed traces of the mildew on the young freshly grown tips of several of the shoots This amount of infection was practically inevitable in view of the fact that the adjacent bushes (untreated) stood smothered with mildew in its powdery infectious summer-stage, from July 12th onwards, so that spores must have been continually blown on to the sprayed bushes Although it was known from previous observations that the spraying would not prevent the mildew already present from forming its winter-stage, lime-sulphur was applied to (1) and (2) as before, for the sixth time.

On November 24th, the final examination of the lime-sulphured bushes was made A plan is given on p. 1066 of the position of the 14 bushes (1) and (2), of the two controls, and of the ten adjoining unsprayed bushes which were examined for comparison. These bushes were gone over in the following manner . all the shoots that showed any of the disease* were cut off, and then separated into two classes as follows :—*Class* 1, with more than one inch of continuously diseased shoot , *Class* 2, with less than one inch of continuously diseased shoot. The examination gave the following results :—

Sprayed bushes (1) *and* (2) *and " controls."*

No of bush in plan	No of shoots with *over* 1 in. continuously diseased	No. of shoots with *under* 1 in continuously diseased.	Total No of diseased shoots
1	1	3	4
2 Control.	23	37	60
3	4	14	18
4	3	7	10
5	7	11	18
6	9	7	16
7 Control.	49	42	91
8	15	9	24
9	14	19	33
10	8	4	12
11	1	9	10
12	1	5	6
13	32	17	49
14	5	5	10

These figures show that the spraying had a considerable effect against the mildew . the average number of diseased shoots per bush on the 12 sprayed bushes was 18, and on the unsprayed " control " bushes it was 75

The good that was done by spraying is seen even more clearly by comparing the amount of disease on the bushes of the three sprayed rows with the bushes (of the same age and size) of the three adjacent unsprayed rows The examination of these unsprayed bushes gave the results shown in the table on p. 1068.

* The mildew was now all in the dark brown " felted " winter-stage.

In this case the average number of diseased shoots per bush was no less than 116, of which 80 had more than one inch of continuously diseased shoot In the case of the sprayed bushes, the average number of diseased shoots per bush was 17.5, of which 8 3 had more than one inch of continuously diseased shoot Thus, of the 210 affected shoots on the sprayed bushes there were 100 with over one inch continuously diseased, or *47 6 per cent*, while of the 1,159 affected shoots on the

Unsprayed Bushes

No of bush in plan	No of shoots with *over* 1 in. continuously diseased	No of shoots with *under* 1 in continuously diseased.	Total No. of diseased shoots
1*	18	9	27
2	73	33	106
3	33	32	65
4	27	41	68
5	102	56	158
6	89	45	134
7	85	31	116
8	140	28	168
9	120	43	163
10	112	42	154

unsprayed bushes, there were 799 shoots with over one inch continuously diseased, or *68 9 per cent* The length of the diseased portion of the shoot which must be removed in "tipping" is of course a point of considerable practical importance, as the removal of many inches means (unless the bush is "spur" pruned) the removal of a considerable part of subsequent crops

A point of possibly considerable practical importance may be noted here On July 28th, one of the bushes of Berry's Early in the plantation noted above which was so badly attacked by mildew, was "tipped" The bush, which stood to the left of the "unsprayed" bushes shown in the plan on p 1066, was quite as badly affected as any of these, the tips of nearly every shoot bearing extensive patches of mildew in the brown winter-stage, so that considerably over a hundred shoots had to be "tipped" In November it was found that no fresh growth of the bush had been caused by this "tipping," and that in its absence there had been no fresh infection of the bush, which was now quite healthy With large bushes of this age, then, in such a season as the past, the winter-stage of the mildew can safely be removed as early as *July 28th*

The plantation (1½ acres) of Berry's Early was sprayed (with the exception of the bushes on Plot 7) by the farmer as follows On May 2nd, ½ acre was lightly sprayed with lime-sulphur at "half strength" (1.005 sp gr.). No injury resulted. The crop was picked on June 9th and June 10th, no sediment was then noticeable on the berries in the sprayed part A trace of mildew was found on a very few berries—

* This was a very small bush, it had mildew on every shoot.

equally in the sprayed and unsprayed parts of the plantation, very probably this early infection of the berries (no mildew occurred on the shoots at this date) was caused by winter-spores arising from the soil On June 11th, the whole plantation was sprayed with lime-sulphur, 1.005 sp. gr. No injury resulted At the beginning of July, the plantation for the greater part became virulently infected, probably by air-borne summer-spores, in many cases over 100 shoots on one bush showed badly diseased tips (see above p 1068) It is very doubtful if the two sprayings of lime-sulphur given to this plantation at the date mentioned above were of any practical use

(The weather conditions at the times of spraying at the Rodmersham centre, as well as at Mereworth and Boughton-under-Blean (see below), and the dates of the appearance of mildew in various parts of the plantations, will be found recorded in the *Journal* of the South-Eastern Agricultural College, 1914)

Centre: MEREWORTH.—*Plot 1.*—*Lancashire Lad.*—The bushes were about 10 years old in a plantation shaded by fruit trees Before the experiments started, all the bushes had been sprayed six times by the farmer, first three times with lime-sulphur and then three times with liver-of-sulphur

June 2 (1) 50 bushes sprayed with lime-sulphur, 1 01 sp gr
(2) 25 bushes sprayed with liver-of-sulphur solution, 2 oz to 3 gall water
June 9 (2) as before
June 21 (1) as before (a light spraying to cover the fresh growth)
(2) as before
July 14 (1) and (2) as before

No injury resulted from the three applications of lime-sulphur, nor any serious injury from the four applications of the liver-of-sulphur solution On June 21st slight leaf-fall, somewhat sporadic and nowhere to any serious extent, occurred on the bushes sprayed with liver-of-sulphur solution

On June 2nd, the mildew in its summer-stage was seen on a few berries, but after a careful search through all the plantations no mildew could be found on the leaves or shoots The mildew was first seen on the shoots on June 9th, but owing to the hot, dry weather which followed causing a "ripening" of the shoots, no serious spread of the mildew occurred during June. On June 21st, a trace of mildew was first observable in the sprayed plot, viz, on the shoots of many of the bushes which had been sprayed with liver-of-sulphur, while no mildew was present on the bushes sprayed with lime-sulphur (On the bushes in another part of the plantation, which had not been sprayed since May, the mildew was thick on the young shoots of many of the bushes) The weather conditions from about June 10th to June 20th were not favourable to the spread of the mildew; and on July 14th there was still no mildew on the bushes sprayed with lime-sulphur, and less mildew on those sprayed with liver-of-sulphur than there had been on June 21st.

The berries which were now ripe were quite free from mildew; those on the bushes sprayed with lime-sulphur were so marked by the spray that they could not have been marketed without treatment. Some of the most severely affected ripe berries of these Lancashire Lads, together with some equally ripe and marked berries from the May Duke bushes sprayed with lime-sulphur (see above *Plot 4*), were passed through

Fletcher & Becker's "Gooseberry Cleaner" machine By means of its ingenious arrangement of brushes, this machine removed the wash satisfactorily from the sides of the berries, without bruising them, and so made the sample quite bright and of normal appearance, traces of the wash could still be seen, on close inspection, at the eye and round the stalk, or where a wrinkle occurred in the skin, but such minute spots would not, of course, affect the market value.

Centre: BOUGHTON-UNDER-BLEAN.—*Plot 1.—Cousins' Seedling.*—The bushes were six to ten years old in a plantation situated in the open

May 15 (1) 20 bushes sprayed with lime-sulphur 1 01 sp gr
(2) 20 bushes sprayed with lime-sulphur 1.01 sp. gr., *plus* arsenate of lead* (at rate of 2 lb Swift's arsenate of lead paste to 50 gall. of water)
(3) 16 bushes sprayed with liver-of-sulphur 1 oz to 3 gall of water

May 30 (1), (2) and (3) as before (light spraying only, to cover fresh growth)
(4) 8 bushes sprayed with lime-sulphur *plus* arsenate of lead (as before)
(5) 3 bushes sprayed with lime-sulphur 1 01 sp gr

June 13 (1), (2) and (3) as before
(6) 15 bushes sprayed with lime-sulphur *plus* arsenate of lead (as before)

June 26 (1) and (3) as before
(2) sprayed with lime-sulphur 1 01 sp gr
(4), (5) and (6) sprayed with lime-sulphur only, 1 01 sp gr
(7) 21 bushes sprayed with lime-sulphur 1 01 sp gr

July 8 (1) to (7) as before

July 30 (1), (2) and (3) as before

The mildew had been noticed somewhere in the plantation by the Kent County Council Inspector during the first week in May The first appearance of the mildew was noted by the writer on May 30th, when it was found just beginning to develop, on several of the berries and on one leaf, of 11 bushes which had not previously been sprayed Eight of these bushes were at once sprayed with lime-sulphur mixed with arsenate of lead (see above, May 30th (4)), and the three remaining bushes with lime-sulphur alone (5) On June 13th, the mildew was checked on these 11 bushes At that date 15 more bushes (not hitherto sprayed) were found attacked by mildew, and on some of the bushes the attack was severe, many of the shoots being quite white and powdery with the summer-stage These 15 bushes were sprayed with lime-sulphur mixed with arsenate of lead (see above, June 13th (6)) On June 26th, the mildew had appeared on 21 "control" bushes, which showed the tips of shoots here and there affected with both summer- and winter-stages. These were sprayed with lime-sulphur, 1 01 sp gr (see June 26th (7)). About June 26th the mildew was checked by a spell of hot, dry weather, which caused the shoots to turn somewhat red and ripen

* The addition of arsenate of lead to lime-sulphur has been stated by experimenters in the United States to add considerably to the fungicidal property of the latter. Owing to the poisonous nature of arsenate of lead, such a mixture must not be used on fruit within at least six weeks of the time of picking.

off. The 40 bushes in (1) and (2) showed no mildew on them, the tips of the shoots, which had now grown out, were lightly sprayed over again; the 16 bushes in (3) showed a slight trace of mildew on two of them, the 26 bushes in (4), (5) and (6) showed no living mildew on them, but this fact may have been due to the unfavourable weather conditions; the bushes in (7) showed only the patches of winter-stage still remaining On July 8th, there was no mildew in the spreading infectious summer-stage on any of the patches On July 30th, a trace of mildew in the summer-stage was present on the bushes which had received the liver-of-sulphur solution (3), very little fresh growth had been made by any of the bushes At this date the berries were picked from the bushes (1) and (2) which had received five successive sprayings with lime-sulphur,—the last application having been on July 8th The berries were a good deal marked by the wash, as the bushes had been heavily sprayed, the handling of the berries in picking them, however, removed a considerable amount of the deposit Before sale they were simply rinsed in water, no complaint was received from the salesman

As at the Rodmersham centre, no injury whatever resulted from the six successive applications of "full strength" lime-sulphur

Experiments carried out in the United States have indicated that the sprays containing sulphur are more efficacious in stopping the spread of American gooseberry mildew in the summer-stage than those containing copper. In America the liver-of-sulphur solution, at the strength of 1 oz. to 2 gall. of water, with about seven applications at intervals of ten to twelve days, is generally recommended as the best fungicide. It is quite clear, however, that in this country this spray is powerless to check the spread of the mildew in severe outbreaks, even when it is of a greater strength and applied at shorter intervals (see p. 1063), and the lime-sulphur wash has given decidedly better results. Lime-sulphur also has the great practical advantage over the liver-of-sulphur wash, and over flowers-of-sulphur, that it is, when once dry on the bush, so remarkably adherent that even heavy rains do not wash it off It is very probable that flowers-of-sulphur would prove as efficacious in the summer in checking the spread of the American gooseberry mildew as it has proved against the very closely-allied hop mildew (*Sphaerotheca Humuli*). It must be remembered, however, that flowers of-sulphur is efficacious in dealing with the hop mildew apparently only in periods of sunshine and high temperature, while rain removes it at once. It is obvious, therefore, that flowers-of-sulphur is very unsuitable for use in spring when there are frequently long periods of low temperatures, and showers nearly every day. It is intended, however, to experiment next season with flowers-of-sulphur to ascertain if it will prevent mildew in summer on the crop of late dessert varieties of gooseberries.

It may be pointed out that the recommendation often given in the horticultural press to use a mixture of slaked lime and sulphur cannot be supported on either chemical or biological grounds. Slaked lime and sulphur when mixed at the ordinary temperature do not interact chemically, so that the addition of such lime to sulphur will only mean the application of a smaller quantity of sulphur. Recent experiments* have shown that the fungicidal action of lime and sulphur is very considerably less than that of sulphur alone. Where the two were tried against hop mildew, the following results were obtained :—

—	Hops					
	Free from Mildew.		Slightly affected		So badly affected as to be valueless	
	Number	Per Cent	Number.	Per Cent	Number	Per Cent.
Sulphur	1,296	61 2	610	28 8	213	10 0
Lime and Sulphur	535	12 3	1,273	29 4	2,530	58 3

The author of the Bulletin referred to remarks. "The above results are of some interest in connection with the theory of the action of sulphur. A considerable amount of work has been done which seems to indicate that the action of sulphur is due to the gradual oxidation of the sulphur, forming sulphurous acid in the presence of water, which in turn is oxidised to sulphuric acid. These acids in dilute solutions have been shown to destroy the mildew. In the presence of lime these acids would naturally unite with the lime, forming compounds quite insoluble and presumably quite harmless to the parasite."

Owing to the remarkably adhesive properties of lime-sulphur, the fruit of sprayed bushes becomes much marked by the dried wash. The degree of disfigurement of the crop varies a good deal according to the nature of the berry in the different varieties. In one case where some bushes of Gunner's Seedling

* Bulletin 328, Cornell University, Agric. Exper. Station, 1913.

and Cousins' Seedling were sprayed lightly with "half strength" lime-sulphur on June 17th, the berries when ripe on July 28th, showed a noticeable amount of deposit, particularly in the case of the former variety. The marks in this case, however, were rubbed off to a considerable extent in the process of picking, and the berries were marketed without treatment, and no complaints were received. In another case, berries of Cousins' Seedling were picked for market on July 30th from bushes which had been heavily sprayed with lime-sulphur at "full strength" on July 8th. Although these berries when on the bushes were much marked with the whitish sediment of the wash, the handling of them in the operation of picking removed a good deal of it. These berries were then merely rinsed in water, and marketed, and no complaints were received. With other varieties, however (*e.g.*, Lancashire Lad), it is more difficult to clean the berries. In such cases either repeated rinsings in water must be given, or the crop must be passed through the lately-invented Fletcher and Becker "Gooseberry Cleaner." One type of this machine grades the berries as well as cleans them; on farms where there is a large acreage of gooseberries, or in a district where co-operative marketing has been organised, the better prices obtained through the grading would in all probability justify the adoption of this machine commercially.

It may be well to point out here that there is no danger to the public health in the marketing of berries sprayed with lime-sulphur Sulphur is not a poison, and the very small quantities present on such berries could not possibly cause any disagreeable effects. Some berries of Howard's Lancer, so heavily sprayed with lime-sulphur as, when dry, to be covered with the whitish deposit, were boiled with sugar as in ordinary domestic cookery, no objectionable smell was given off during the cooking, and the berries when eaten had no objectionable taste or unpleasant after-effects.

2.—*Observations on the Life-history of the American Gooseberry Mildew.*

Some new scientific facts of practical importance were noted at the beginning of last August in a plantation where the crop was badly affected. On examining the berries it was found that the ripe perithecia had become free from the hyphae of the brown scurf-like mycelium investing the diseased fruit, and now fell readily to the ground. On a mildewed berry being gently tapped over a piece of white paper, hundreds of

just visible black "specks" could be observed on it; these were found to be ripe perithecia containing mature winter-spores (*ascospores*). Experiments showed that these ripe perithecia, when kept supplied with moisture for a few days and at ordinary room temperature, open by a slit in the wall and the contained sac (*ascus*) with its winter-spores (*ascospores*) swells and protrudes (see Fig. 3). In a short time the wall of the ascus breaks at the apex and the ascospores are forcibly discharged. It is very probable that with suitable weather conditions this discharge of winter-spores takes place in mid-summer in the plantation; if so, such winter-spores will serve to spread the disease the same season that they are produced.* It is probable, too, that many of the perithecia that fall to the ground from the diseased berries remain dormant in or on the soil until the following spring, when they will cause new outbreaks of disease.†

In the light of these fresh facts it is a matter of great practical importance in fighting the mildew not to allow berries with any brown winter-stage on them to remain on the bush, as there will always be the serious danger of the soil under the bushes becoming heavily infected with winter-spores—in which case spraying in the next season would probably be of little avail in keeping off the mildew from the berries (see p 1064). To some extent, also, the perithecia begin to drop in August from the mature patches of mildew in the winter-stage which have been formed on the shoots. How far this is exceptional or not—whether, *e.g.*, it occurs only when the winter-stage has been formed very early in the season, or whether it is dependent on special weather conditions at some stage in the development of the mildew—must be ascertained by future investigations. It is certain, however, that during the past season infection of the soil occurred in August in many plantations in Kent, where late dessert varieties of gooseberries are grown

Another fact of considerable practical importance was the very frequent occurrence during the past season of the winter-stage of the mildew *on the leaf* of the gooseberry. In cases where the shoot was severely attacked, the young leaves were arrested in growth and ultimately became completely covered with the brown winter-stage of the fungus (see Fig. 2). Shoots

* The writer has shown that this can take place in the case of the allied mildew *Erysiphe Graminis* on corn and grasses.

† It seems probable that, in those cases where the berries are attacked *before* the leaves or shoots, infection has resulted by winter-spores *arising from the soil.*

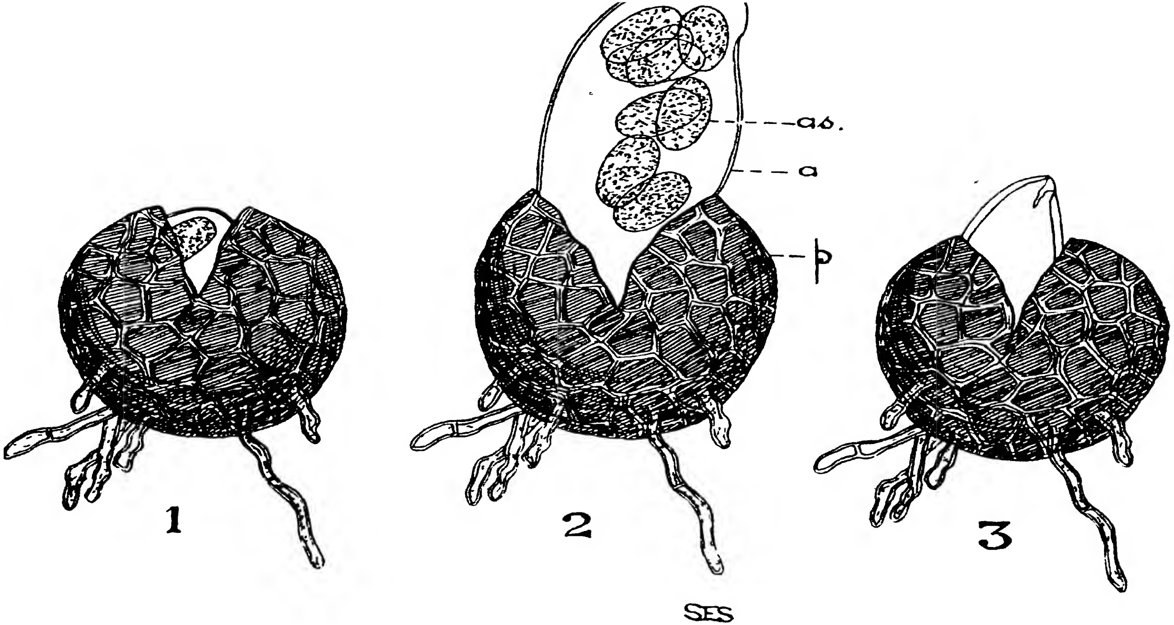


FIG. 2 —Three stages in the dehiscence of the *perithecium* of the American Gooseberry Mildew. *p*=*perithecium* ; *a*=*ascus* ; *as*=*ascospores*. Highly magnified.

—The perithecium splits open by a crack at the apex , the enclosed ascus begins to swell and protrude through the opening.

—The stage reached in about five minutes. The ascus has swollen enormously (to about 8 times its original volume when contained in the perithecium), and in consequence its wall is in a state of great tension. After a short time, as the result of an increase in tension, the wall of the ascus bursts near the apex (where the wall is thinner from the first, forming a "pore"), and the 8 ascospores are expelled forcibly into the air to a distance of about 1 inch.

—Directly the ascospores are shot out, the empty ascus, now reduced in size and with a thick wall, shrinks back somewhat into the perithecium.

with the leaves affected in this way could be found by the hundred during August in badly affected plantations in many parts of Kent. In other cases of equally common occurrence, the leaf itself was not affected in size or shape, and the disease was confined to the lower part of the leaf-stalk, where a small brown patch of the winter-stage occurred. In either case, if such diseased leaves are allowed to fall to the ground they inevitably infect the soil, with the result that next spring the winter-spores cause fresh outbreaks of mildew. To prevent infection of the soil it is desirable to "tip" in August before the leaves fall.

A further point in the life-history of the mildew not sufficiently recognised hitherto, is the fact that the winter-stage may be developed almost at the very beginning of an attack. This fact is of great practical importance, as it makes the control of the mildew by spraying alone almost impossible. Two cases, out of many observed during 1913, may be noted. On May 26th some bushes of Cousins' Seedling which were under observation showed no mildew; on June 6th these bushes, 19 in number, were all diseased, and on three of them the winter-stage was already well-developed. Inoculation, the incubation period, and the development of the winter-stage had all taken place in not more than 11 days. Again, on June 13th some bushes of Cousins' Seedling, which had been kept under observation on another farm, were quite free from mildew, on June 26th all these bushes (21 in number) were diseased, both the winter- and summer-stage being present; here the period was 13 days. The fact that the winter-stage sometimes appears very early in the season also undoubtedly makes the work of combating the mildew more difficult.

The winter-stage was found in a plantation of Cousins' Seedling in Kent last season as early as May 26th, and by June 6th it was found in a mature condition on numerous bushes of several varieties. In 1912, in Kent, the winter-stage with ripe winter-spores was found on July 17th on both the leaves and shoots of the red currant.

Since the summer- and winter-stages appear almost simultaneously at all times of the season, it is quite obvious (as it is commercially impossible to keep all the shoots continuously sprayed throughout the growing period, and no known spray will kill the winter-stage) that some amount of "tipping" to remove the winter-stage will always be absolutely necessary; early "tipping" must be regarded as a measure of primary importance, and spraying at certain times only as a valuable adjunct.

3.—*General Remarks and Conclusions.*

It will probably now be conceded that, wherever American gooseberry mildew is prevalent, new methods of cultivation will to some extent be necessary in order to place the growing of gooseberries on a safe commercial footing. Where gooseberries are being grown under the shade of trees, so closely crowded that no spraying can be done, the consequent lack of ventilation and the delayed drying of the bushes and soil after rain, mists or heavy dews, cause outbreaks of the mildew to assume epidemic proportions, and all such plantations are doomed.

The plantations likely to prove commercially successful in withstanding the mildew are those in which the following conditions of cultivation are found .—(1) An open situation. (2) Bushes not too closely planted. (3) Bushes of a variety that will not be injured by spraying. (4) Bushes with a natural unforced growth, such as is obtained naturally in a good soil, or by well-balanced manuring. Excessive nitrogenous manuring, *e.g.*, heavy dressings of organic manures, causes the bushes to produce sappy shoots which become virulently attacked by mildew. Experiments with the best commercial varieties should be undertaken to ascertain whether "spur" pruning, under which system the tipping of diseased shoots does not reduce the next season's crop, has advantages from the point of view of dealing with the disease ; or whether the abundance of young shoots induced by "spur" pruning is a serious handicap At any rate, such varieties as Cousins' Seedling should be pruned in such a way as to encourage an upward growth of the branches.

With regard to the direct methods that can be employed against the mildew, it seems clear that the early removal and destruction of the diseased shoots and berries is essential for success. Mildewed berries must be removed before the ripe winter-stage has formed on them Spraying with lime-sulphur on the lines indicated below may prove to be a valuable help, but it is second in value to the removal of the shoots and berries. If through negligence the early removal of the affected shoots and berries is not carried out, and the soil thereby becomes infected with the perithecia, repeated sprayings may be powerless to save the crop or prevent outbreaks on an epidemic scale.

The lime-sulphur spray at full strength (1.01 sp. gr.) can be used during the early part of the season, April to June, and probably during July in most years, on the following varieties, without causing any serious injury, even when applied several

times successively to the same bushes :—*Whinham's Industry, Rifleman, Warrington, May Duke, Howard's Lancer, Gunner's Seedling,* and *Cousins' Seedling* (*Sandwich Yellow*), and, when growing in a shaded position, *Berry's Early* and *Lancashire Lad.*

The following varieties are liable to be injured if the bushes are sprayed many times successively, or if they are situated in a sunny position :—*Berry's Early, Freedom, Lancashire Lad,* and *Crown Bob,* and it is therefore advisable to use " half-strength " lime-sulphur (1.005 sp. gr.) on these varieties, and to avoid spraying late in the season.

The varieties *Yellow Rough* (*Golden Drop*) and *Valentine's Seedling* show so marked a susceptibility to injury that they cannot be sprayed.

In early seasons spraying should be commenced in mid-April, in plantations where the disease appeared in the previous season ; in other circumstances, the first week in May is early enough , the spraying should be continued at intervals of about a fortnight until it interferes with the marketing of the fruit (see pp. 1072-3) when liver-of-sulphur solution or flowers-of-sulphur should be tried to stop the spread of mildew to the fruit. By this means it should in most cases be possible to grow a clean crop of berries. In cases, however, where the soil has been infected, it will probably be found that the berries become mildewed in spite of spraying.

Whilst spraying in May and June with lime-sulphur, *before the mildew is on the bushes,* appears, with many varieties, to be a practicable means of preventing infection early in the season, and thus of saving the crop, it is certain that the spraying of good-sized gooseberry bushes throughout the growing season is not commercially advisable. Even if it were thus possible entirely to prevent infection (extremely doubtful considering the constant growth of the shoots) the cost in labour of the repeated applications would be prohibitive. Neither lime-sulphur nor any known spray kills the winter-stage of the mildew, and, as was observed repeatedly during 1913, outbreaks of mildew frequently occur in which the winter-stage suddenly appears almost simultaneously with the summer-stage (see p. 1075). It is almost certain, therefore, that in every case of mildew in a plantation some "tipping" of diseased shoots must be done. After the crop has been gathered a good final spraying with lime-sulphur should be given. The mildew must then be allowed, in most cases, to attack the later growth of the shoots. By August a greater or less amount of disease will probably be found on the tips of the shoots ; and this amount of disease

must be expected until far more thorough and systematic methods of control are devised and generally adopted. With young and valuable plantations, close attention to the date of the first appearance of mildew, and repeated sprayings to cover all fresh growth, may render it possible to rear the bushes without having to "tip" them for disease to an extent that will seriously injure their growth. This will be possible, however, only if the diseased tips of the shoots are collected and destroyed in good time each season.

Taking everything into consideration, tipping in August or early in September before the leaves have fallen is strongly to be recommended in all cases where anything like a severe attack of mildew has occurred. In some seasons and with bushes of a certain age no further growth of the shoots will take place after this tipping is done (see p. 1068), and if all the mildew has been cut off, the bush is quite healthy again, since the disease is strictly external and confined to the young wood. If, as will be probable in some seasons, a slight fresh growth is made and this becomes infected with mildew, the grower will still be in a better position, since there will certainly be much less disease to be removed before the perithecia fall to the ground, or even should they fall, owing to postponement of the second "tipping" through an unavoidable scarcity of labour, there will be much less severe infection of the soil than if no tipping at all were done until October or November. On many large fruit farms, as well as on small holdings, it is possible to find labour for the "tipping" of the shoots during the early part of August (before apple picking begins). It should now be realised by the commercial fruitgrower that it will pay better to go over infected gooseberry plantations in August and carefully remove and burn all diseased tips than to wait until late autumn, when labour is again available. If tipping is done in August, the diseased leaves (with their winter-spores in the perithecia) will be prevented from falling to the ground, while the diseased shoots will be destroyed before the perithecia have begun to fall from them to any considerable extent.

With strict attention paid to the collection and destruction of all berries which show any winter-stage on them*, to the tipping of the diseased shoots in August, and to spraying early in the season with lime-sulphur, it should be possible and

* There is no danger of the soil becoming infected from berries which have only the *white* summer-stage on them, but as soon as the berries show any *brown* winter-stage the crop should be picked and marketed, after the berries have been looked over and the mildewed ones destroyed.

commercially practicable to grow a crop of gooseberries free from mildew. On small holdings, and on bigger farms where gooseberries are grown in open plantations, and where sufficient labour is available at the necessary times, gooseberry growing can still be practised with hope of success, but only if the altered conditions of culture rendered necessary by the establishment in this country of American gooseberry mildew are carefully borne in mind.

SOME DOUGLAS FIR PLANTATIONS.

V.—DUNSTER, SOMERSETSHIRE.

THE wood is the property of Mr. Luttrell, by whose courtesy facilities were afforded for making a detailed examination.

1.—*Geographical Position and Area.*

The wood, with an area of 0.84 acre, is situated in the parish of Dunster, Somerset, and is about three miles from Minehead and the Bristol Channel.

2.—*Altitude Aspect, Exposure and Slope.*

The lower edge of the wood is 385 ft. above sea level; it is situated on a rather steep slope with an aspect varying from north by west to north by east. The wood is surrounded by fields. The prevailing wind is south-west by south; the top of the wood is the least sheltered portion, but even here shelter is afforded by a ridge to the west, south and south-west, at a distance of ¼ to ¾ mile and subtending an angle varying from 6 deg. to 9 deg. What prevailing wind there is sweeps over this ridge and over the field to the south-west, and its effect is seen in the outermost rows of Douglas fir on the south-west boundary, these being very much poorer in height growth than those further in the wood and down the slope. For any species but Douglas fir, however, the shelter would be good. The trees in the lower half of the wood are naturally well protected and show no effects of wind.

3.—*Geology and Soil.*

To ascertain the nature of the soil, which overlies rocks of the Devonian age, and of the subsoil, three holes were dug: No. 1 in the lower third of the wood, No. 2 in the centre third, and No. 3 in the upper third. The holes were dug 3 ft. deep.

In No. 2 hole there was 1 in. of humus covering 5 in. of stony loam, and the subsoil was very stony, red loamy sand; at 3 ft. it became too stony to go any lower without a pick.

In No. 1 hole the soil and subsoil were similar, except that the latter was not so red.

In No. 3 hole the soil was as above, but the subsoil was even more stony, consisting of about 90 per cent. of hard sandstone broken up into pieces the size of a man's fist or smaller, but with hardly any soil in the interstices.

4.—*Climate.*

Records of temperature and rainfall are available for the last three years for Minehead, which, as stated above, is only three miles distant ; the average figures for the period 1910 to 1912 are as follows :—

(*a*) Rainfall—

Total annual fall	37 in.
Number of rainy days annually ..	182

Rain falls in every month of the year.

(*b*) Temperature in the shade.

Absolute maximum	92° F.
Absolute minimum	19° F.
Mean maximum daily temperature	60° F.
Mean minimum daily temperature	45° F.

The climate generally is equable and moist.

5 —*History of Wood*

The wood was planted in 1880. The plants were purchased, and first put in the estate nursery and then planted out when 2½ ft. to 3 ft. in height ; the spacing was 10 ft. by 10 ft. No live trees had been taken out up to last year, but a thinning is now in progress. In December, 1906, the wood was examined by Mr. H. E. Elwes, and the results of the examination are given in Vol. IV. of " The Trees of Great Britain and Ireland."

6.—*Condition of Wood.*

(1) *Method of Examination.*—The method of examination was similar to that adopted in the case of the Tortworth Douglas Fir Plantation.* The sample area selected (containing 0.44 acre) included, however, the greater part of the entire wood, a strip round the boundary alone being excluded. It was found possible to fell three of the 15 sample trees chosen for measurement. Detailed figures are given in Table II.

(2) *Stocking.*—Excluding dead trees, the number of trees in the sample area is now 342 per acre. In the whole wood the number per acre is 298 as compared with 314 in 1906. The canopy is complete and the wood might be subjected to a careful thinning.

* *Journal*, January, 1914, p. 865.

(3) *Diameter-Growth.*—The average diameter of the trees in the normally stocked sample area is 10.4 in., corresponding to an annual increase of 0.31 in. The largest trees in the sample plot and whole wood were of 15 in. and 19 in. diameter, respectively. The larger trees outside the sample area were abnormally big on account of their situation on the boundary. The numbers of trees under the various diameter classes are given in Table No. I.

TABLE NO. I.

Tree Enumeration.

Diameter Class in inches.	5½ to 6½	6½ to 7½	7½ to 8½	8½ to 9½	9½ to 10½	10½ to 11½	11½ to 12½	12½ to 13½	13½ to 14½
Number of stems :									
Sample area ..	–	4	15	30	34	34	20	8	6
Remainder ..	1	1	6	12	11	17	16	6	9
Whole wood .	1	5	21	42	45	51	36	14	15

Diameter Class in inches—(*contd.*)	14½ to 15½	15½ to 16½	16½ to 17½	17½ to 18½	18½ to 19½	Total No. of stems.	Equivalent No of stems per acre.
Number of stems .							
Sample area .	3	–	–	–	–	154	350
Remainder	9	5	5	3	1	102	255
Whole wood .	12	5	5	3	1	256	305

NOTE.—Of the above trees 6 are dead.

(4) *Height-Growth.*—The figures for full height and height to 3 in. diameter of the sample trees are as follows :—

	Height in feet.					
	Full height			To 3 in diameter.		
	Min	Max.	Av'ge.	Min.	Max.	Av'ge.
Total . ..	56	93	74	45	78	60
Annual increase..	1 7	2.8	2.2	1.4	2.4	1.8

The height-growth curve (page 1084) has been obtained for sample trees Nos. 3, 5, and 6, by measuring the distance between the nodes. It is interesting to note the effect of exposure on the growth in height; this comes out not only in the height-curve diagram, but also in the heights of the sample trees in the three zones into which the wood may be divided, viz.:—

In the upper third: most exposed		In the centre third: fairly sheltered.		In the lower third: well sheltered	
To 3 in diameter.	Total.	To 3 in. diameter	Total	To 3 in. diameter.	Total.
feet 51 8	feet 59 5	feet 62 4	feet 70 6	feet 63 1	feet. 81 2

The largest measured shoot of any one year was 4 ft. 2 in.

Where not subject to exposure, 12 in. to 20 in. is still being put on annually in height.

(5) *Volume of Timber.*—The figures showing the calculation of the volume of timber are given in Table II.

The volume of each class was obtained by calculating the volume of the sample trees representing the class and then using the equation:—

$$\frac{\text{Volume of whole class}}{\text{Volume of sample trees}} = \frac{\text{Sectional area at } 4\tfrac{1}{2} \text{ ft of all trees in class}}{\text{Sectional area at } 4\tfrac{1}{2} \text{ ft of the sample trees.}}$$

All figures are for volume over bark true measurement.

The results are as follow:—

	Volume of timber in cubic feet			
	Total per acre	Per tree.	Average annual increment: Per acre	Average annual increment: Per tree.
Whole wood ..	6,640	22	202	0.7
Sample area ..	6,350	18	192	0 5

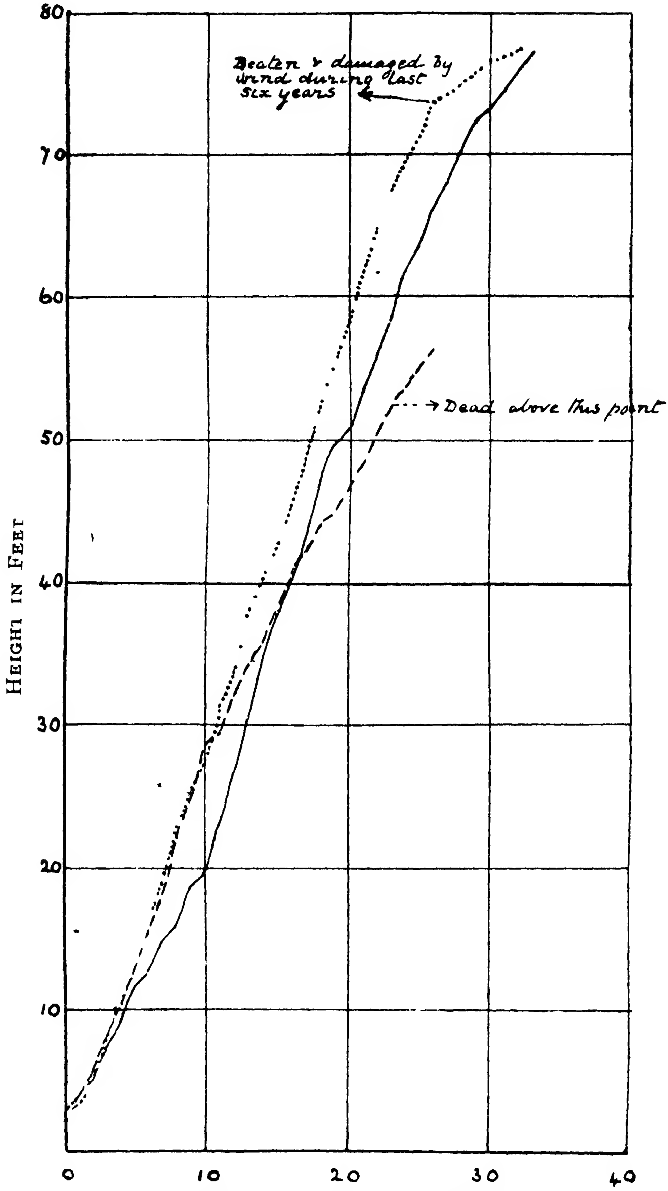
The yield per acre and the average annual increment are very large. The volume per acre is greater in the whole wood

TABLE II.

Diameter class.	Actual Trees measured.								Sample Plot (0.44 ac.)				Whole Wood (0.84 ac.)			
	Third of wood in which situated	Serial No	Diameter		Height		Volume of timber to 3 in. diameter	Form factor	Sectional area at 4 ft. 3 in. of all trees in the class	Volume of Timber			Sectional area at 4 ft. 3 in. of all trees in the class	Volume of Timber		
			At 4 ft. 3 in.	At half height to 3 in. diameter	Total	To 3 in. diameter				Total	Per acre			Total	Per acre.	
											Total	Average annual increment.			Total.	Average annual increment.
in.			in.	in.	ft.	ft.	cub. ft.		sq. ft.	cub. ft.	cub. ft.	cub. ft.	sq. ft.	cub. ft.	cub. ft.	cub. ft.
6½ to 8½	Centre	1	7.9	5.7	59.9	52.7	9.34	46	6.31	170	390	12	8.86	250	300	9
	Lower	2	8.0	5.8	66.5	53.0	9.72	42								
8½ to 9½	Upper	3	8.9	7.0	56.3	45.0	*12.51* / 12.01	*51* / 49	13.25	370	840	25	18.56	520	620	19
	Lower	4	8.9	6.4	77.3	54.0	12.06	36								
9½ to 10½	Lower	5	9.9	6.2	77.2	61.5	*15.83* / 12.89	*38* / 31	18.54	460	1,050	32	24.54	600	710	22
	Centre	6	9.9	6.5	77.5	65.0	*17.63* / 14.98	*43* / 36								
	Upper	7	9.9	6.4	—	52.0	11.62	—								
10½ to 11½	Lower	8	11.0	8.5	80.9	64.5	25.42	48	22.44	700	1,590	48	33.66	1,050	1,250	38
	Upper	9	11.1	7.7	—	51.7	16.72	—								
	Centre	10	11.1	7.8	74.3	61.3	20.35	41								
11½ to 12½	Lower	11	11.9	8.4	91.6	67.5	25.98	37	15.71	480	1,090	33	28.27	870	1,030	31
	Centre	12	11.9	8.1	65.6	60.5	21.65	43								
12½ to 15½	Lower	13	13.9	9.2	93.5	78.2	36.10	37	17.47	610	1,390	42	43.67	1,520	1,810	55
	Upper	14	13.6	10.5	62.7	58.5	35.18	56								
	Centre	15	13.9	9.7	75.8	72.7	37.31	47								
15½ to 19½	—	—	—	—	—	—	—	—	—	—	—	—	22.13	770	920	28
	Total	—	—	—	—	—	—	42	—	2,790	6,350	192	—	5,580	6,640	202

NOTE.—The Volumes and Form Factors in italics were calculated from measurement of the bole in 5-ft. lengths.

Height-Growth Curve.



YEARS FROM DATE OF PLANTING.

— — — — Sample tree No. 3: in upper third of wood, 3rd row from top.

——————— Sample tree No. 5: in lower third of wood.

. . . . Sample tree No. 6: in centre third of wood.

than in the sample plot because of the large size of the boundary trees, which make an abnormal difference in such a small wood. The average volumes to 3 in. diameter of the sample trees in the three zones are 19 cub. ft. in the upper, and 21 cub. ft. in the lower and centre zones; thus the comparatively great exposure of the upper third of the wood has a marked effect on the yield. Unfortunately the figure giving the result of the calculation of the volume of the wood in 1906 is not sufficiently accurate to permit its use for the purpose of comparison with the present volume, since on that occasion the volume of all boles was taken to a height of 42 ft. and not to the actual point where the bole was of a fixed minimum girth.

It was found, on actual measurement of the three felled trees, that, the degree of taper in the upper half of the tree being less than in the lower half, the actual volume is on an average greater than that calculated from the mid-sectional area. The increase in volume is 4, 23 and 18 per cent. in the case of trees Nos. 3, 5, and 6, respectively, or, on an average, 15 per cent.

(6) *Form Factors.*—Calculating from the known heights, volumes and sectional area, at 4½ ft. and at mid-length, of the 15 sample trees, the form factor for timber in the round down to 3 in. diameter is 0.43. The high form factor of trees Nos. 3 and 14 is due to their being in the upper third of the wood, where the exposure has affected the height-growth.

The form factor for trees Nos. 3, 5 and 6, upon this basis, is 0.39: calculating from the actual measurements of these trees cut up into five-foot lengths the form factor is 0.44.

(7) *Natural Enemies.*—A number of the trees in this wood have dead tops. This cannot be ascribed to exposure, as in some cases the dead top is quite straight, and trees adjoining it and in similar shelter may be quite healthy. A tree with a bad top was felled and examined; a depression was found at the base of the dead leader and it was thought that this might be the seat of a cankerous growth and the cause of the trouble. The authorities at Kew have, however, reported that the depression is due to the parasitical fungus *Exosporium laricinum* which only does local damage and would not be the cause of the death of the leader; they advised the examination of the roots, and this will be shortly undertaken. No trace of other fungoid or of insect attack was noticed.

(8) *Natural Regeneration.*—Douglas fir freely reproduces itself naturally from seed in this locality. There were many seedlings of the year in the wood but apparently the canopy

is too dense for them to live more than twelve months. Elsewhere on this estate trees from self-sown seedlings were seen, up to 24 in. girth and 35 ft. in height, which appeared to be very healthy, some being in the open and some in medium shade. Some 2,000 natural seedlings have been taken into the estate nursery.

(9) *Value of the Wood.*—Douglas fir timber is used on the estate, and the bailiff esteems it as good as larch.

The value of the timber per cubic foot may be taken at 6d. a foot as measured, giving an average value of about £166 per acre for the whole wood, and £159 per acre for the normal sample plot.

The cost of planting and fencing as given in the "Trees of Great Britain and Ireland" was £6 per acre, which at 3 per cent. compound interest for 33 years represents approximately £16.

The annual expenditure on up-keep and supervision may be taken at 4*s.* an acre; the present value of this amount at 3 per cent compound interest would be £11. The net return per normal acre, supposing the wood clear-felled, would therefore be £159—(16 + 11) = £132.

This sum, on a 3 per cent. compound interest basis, is equivalent to an annual rent of £2 8*s.* per acre.

VI.—CONCLUSION.

The woods which have been selected as subjects for this series of articles upon Douglas fir plantations have not been chosen because of the remarkable results which their measurement has presented. The only reason for their selection has been that, so far as could be ascertained, they are the oldest woods of pure Douglas fir which have been grown in large enough masses to allow of the selection of sample plots of sufficient size to represent actual forest conditions.

For comparative purposes the results have been summarised in the appended table. In the case of Tortworth* and Dunster the figures given are those for the normal sample area, since the figures for the whole area, in either case, would be based too largely upon measurements of trees grown under abnormal conditions. The estimated value of the standing crop is, with the exception of Cochwillan and the 1883 wood at Tortworth, that given by the author of the relative article: in each of

* Since the publication of the article upon the Tortworth Wood it has been learned from Lord Ducie that the older part of the wood was planted in 1869 and not 1872 as stated. The figures in the table below have been corrected accordingly. It has also been learned that the proper name of the wood is "Iron Mill Wood."

Name of Wood.	County	Age from planting.	Mean height of dominant crop.	Mean diameter of dominant crop at 4 ft 3 in	Number of stems per acre.	True Volume over bark per acre of standing crop.*	Estimated value per cub. ft.	Estimated value of standing crop per acre.	Equivalent gross soil rental per acre on basis of £5 per acre for planting and 3 per cent. compound interest
		years.	feet	inches		cub. ft	pence.	£	£ s. d.
Taymount ..	Perth	52	88	17.5	149	8,460	5⅓	188	1 7 0
Cochwillan ..	Carnarvon ...	58	101	22.6	119	14,110	6	353	2 3 0
Llandinam ..	Montgomery	28	66	11.2	347	7,960	4⅕	139	3 0 0
Tortworth ..	Gloucester	43†	97	15.1	215	9,320	6	233	2 10 0
		29	66	12 3	206	4,700	4	78	1 9 0
Dunster.. ..	Somerset	33	74	10 4	350	6,350	6	159	2 13 0

* The basis upon which true volume has been calculated in each case is as follows at Taymount and Cochwillan, 10 ft. sections; at Llandinam, 6 ft. sections; at Tortworth and Dunster, sectional area at half height to 3 in diameter × height of tree to 3 in. diameter.

† See note on p. 1086 above.

these cases no estimate was made in the article, and the figures given are based on the assumption that the timber would realise 6*d.* and 4*d.*, respectively, per cubic foot, true volume over bark. A word should perhaps be said as to the final column: in order to afford a uniform basis for comparison, the estimates of net profits given in the various articles have been disregarded; instead, the annual gross revenue has been calculated on the following basis:—

The sum of £5 (which, it is assumed, may be taken as the normal cost of planting one acre) has been capitalised at 3 per cent. compound interest over the number of years since the date of planting, and the resulting amount has been deducted from the estimated value per acre of the standing crop, no deductions being made for rent, maintenance or other outgoings, and no credit being taken for the value of any thinnings; the figure thus obtained has been treated as the amount of a certain sum accruing annually at 3 per cent. compound interest over the period of the wood's growth. How far this annual sum differs from the actual revenue likely to be obtained in any particular case may be seen on reference to the relative article.

THE CULTIVATION OF SEAKALE.

E. BECKETT.

SEAKALE (*Crambe maritima*) is, as the specific name denotes, a native of our coasts, where, in its natural state, it exists as a hardy perennial. When cultivated, however, by market and private growers, it is one of the most valuable and also one of the most wholesome vegetables grown. One reason for this is probably the fact that it is ready for consumption from November till May, a period when succulent vegetables are commonly all too scarce and little variety is available.

In order to obtain good crowns for forcing, a proper system of cultivation is necessary, for though this plant is not exacting in its requirements, certain conditions must be observed to ensure the best results.

Preparation of Soil.—An open site should be selected. The ground should be well and deeply cultivated either by trenching or double digging, and as the work proceeds a liberal supply of well-decayed farmyard manure should be added, this being the best manure for the crop. This should be done early, so that the action of the weather may aid in bringing the soil into good condition.

Sowing.—Seakale is easily raised from seed, though it is not generally propagated in this way, the taking of root cuttings being a quicker method. It may, however, be useful to describe the method of propagation by seed. The seed is sown thinly in drills on well prepared ground that has been reduced to a good tilth. If the seed is sown where the crop is intended to remain, the drills should not be less than two feet apart, but a slightly greater distance will not be detrimental. The seeds are sown in pinches at similar intervals apart in the rows. If, however, the seedlings are to be transplanted to the permanent bed, a course some growers prefer, as seakale is not a difficult subject to handle in this manner, then the drills need not be more than one foot apart. Sowing should be carried out when the soil is in good order during March or April. When the seedlings are large enough to handle they should be partly thinned out. The soil between the rows should be kept well hoed, and during showery weather growth may be assisted by an occasional sprinkling of fertiliser, while a little agricultural salt will also be found beneficial.

Propagation by Cuttings.—Propagation by means of root cuttings or, as they are usually termed, thongs or whips, is generally carried out soon after the crop is lifted. The crowns for early forcing are selected and the rootlets trimmed off, the latter at the first convenient time being cut into lengths, the thickest portions first, to form the sets for planting next spring. They are usually made about six inches long, are tied up in bundles of twenty-five, and placed at the foot of a wall in sand or ashes. Planting is usually done during the month of April, and it is a good plan to start the bundles of root cuttings slightly into growth beforehand ; this can readily be done by standing them close together under the stages of a greenhouse, but in this case they should be thoroughly hardened before planting out.

Planting.—Planting, especially as regards the distance apart, depends entirely upon the intention the grower has in mind. If the crowns when matured in the autumn are to be lifted and stored for forcing in a warm dark structure (see below) and the same circle of operations carried on with the rootlets for next year, as just described, then cuttings may be planted in rows eighteen inches apart and one foot from set to set, planting with a dibber and burying the crowns just under the surface.

Before planting, however, the soil may be given a dressing of wood ashes and soot, and the surface should be reduced

to as fine a condition as possible with a fork, when the positions of the rows may be marked by means of sticks at each end; planting should be done to a line. Forcing the beds as was done years ago is hardly practised now, the only relic of the old method being the large seakale pots, with which the crowns were covered, and which are still found in some places.

Where forcing on the permanent beds is practised, planting must be done to allow a distance of four feet from row to row, and two feet six inches between the sets, which should preferably be planted in groups of three, individuals being five or six inches apart. During the growing season the beds should be kept thoroughly clean, hoed frequently, and given surface dressings of manure in showery weather to induce the formation of strong crowns The crowns should not be forced the first season, or their chances of productiveness over a number of years in succession will not be so good.

Forcing—Forcing is done, as already mentioned, either on the permanent bed or by lifting the crowns and placing them in the dark at a proper temperature In the former method, when the leaf of the plant has matured, the bed should be cleaned and forked over between the crowns, each of which should be covered with a good mound of ashes and a seakale pot. The pots may then be firmly and well covered with leaves, preferably of oak or beech, leaves being preferable to any other material. As the days lengthen less material will be needed to force growth, and for latest supplies a mound of soil placed over the crowns will be found sufficient to induce the growth to force its way to the light and so form the blanched growth desired.

The second method is to pot or box the crowns, using almost any soil for the simple purpose of keeping them moist, and to place them in a warm house or mushroom house where there is a temperature of 55° to 60° Fahr To obtain the best quality of seakale it is necessary to grow it in the dark, and where only small quantities are required a constant succession may be secured by using nine or ten inch pots, placing five or six crowns in each and covering with an inverted pot. For very early supplies the retarded crowns are very convenient; they usually break into growth much more freely than crowns which have only recently commenced their resting period. The variety known as Lily-white has a more delicate and attractive colour than the old type and is now largely grown, though it is possibly not quite so vigorous as some varieties.

A DISEASE OF NARCISSUS BULBS.*

G. MASSEE.

ABOUT three years ago a disease of an unusual nature was met with on various kinds of Narcissus bulbs. During the season of 1913 the disease increased to such a serious extent, that according to the statement of growers on a large scale, entire plots of bulbs were completely destroyed. The injury is due to the presence of a parasitic fungus called *Fusarium bulbigenum*, Cooke & Mass., first described in 1887, the host being given as a Narcissus bulb. At that time it was not recognised as a parasite

As a rule the presence of the parasite is first indicated by the appearance of small, yellowish spots on the leaves. These spots gradually increase in size, become brown and dry, and more or less covered with pale salmon-coloured specks, which are at first more or less gelatinous, but soon become dry and horny when exposed to the air. These coloured patches are masses of Fusarium spores, which are dispersed by various means and infect neighbouring plants. The mycelium present in the leaf can be traced passing downwards into the bulb, where it grows vigorously and spreads rapidly in the fleshy bulb-scales. During the early stage of infection of the bulb, the tips of the scales only are injured, as indicated by the brown colour, the injury, however, gradually extends to the base and enters the "cushion," from whence it spreads rapidly, and very soon the entire bulb is of a uniform brown colour. When this stage is reached the fungus forms delicate whitish sheets between the bulb-scales, and numerous chlamydospores or resting-spores are produced on the mycelium present in the substance of the scales. These spores are globose, colourless, with a thick cell-wall, and are produced at the tips of branches, or occur in chains in the length of the mycelium. They vary from 10–14μ in diameter The Fusarium spores are borne in clusters at the tips of short branches, and in the mass are tinged salmon-colour, but are colourless under the microscope; they are 3-septate, with tips pointed and slightly curved. In size they vary from 40–50 $\times$ 5–6μ.

When a bulb becomes brown, it soon commences to decay, and its complete destruction is hastened by the attacks of various kinds of saprophytic fungi, *Penicillium*, &c., and by saprophytic eelworms, such as species of *Rhabdites*. When bulbs decay in this manner before lifting, as frequently happens,

* From the Kew Bulletin, No. 8, 1913.

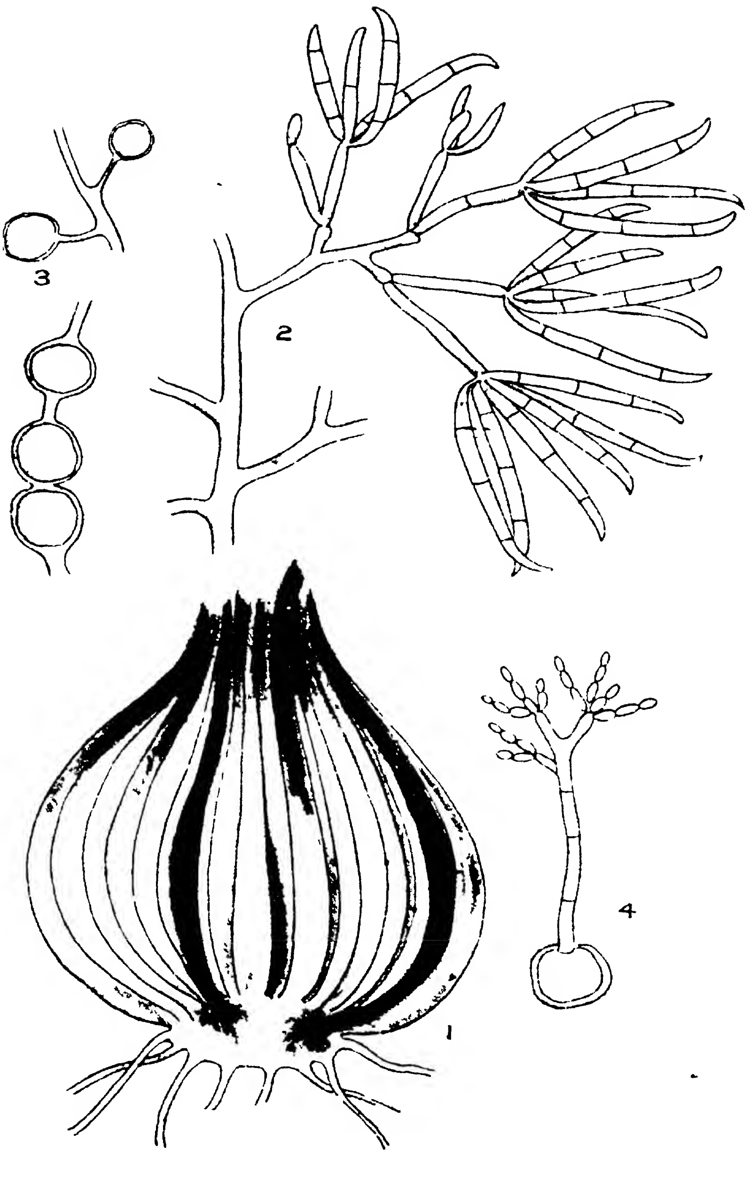
the soil becomes infected by the liberation of the chlamydospores, which infect future crops. The germinating chlamydospores emit one or two short slender branches, which bear a few short chains of minute, colourless, elliptical secondary-spores, measuring about $3 \times 2\mu$. These minute spores are the first to infect Narcissus leaves in the spring, after which the disease is continued throughout the season by means of the Fusarium form of spore.

The young leaves of a Narcissus, about one inch long, were infected with Fusarium spores, and in six days yellowish spots appeared at the points of infection, and as the leaves continued to increase in length, other diseased spots appeared lower down the leaf, mycelium in all instances being present in abundance in the tissues a week after the infection period. It is highly probable that the first infection, by means of the minute secondary-spores produced by the chlamydospores, occurs when the leaves are quite young, and that the disease gradually descends to the base of the leaf and into the bulb, by a series of subsequent infections lower and lower down the leaf, due to independent infections by spores washed from diseased patches higher up the leaf. Chlamydospores are present in abundance in the tissues of the leaves.

The continuance of this disease may be due to two independent causes :—

(1) Slightly diseased bulbs, containing the Fusarium spores or chlamydospores. Such bulbs are not readily detected when the injury is slight ; however, when cut in two the presence of disease is readily indicated by the browning of the scales near the neck of the bulb. It is very doubtful whether soaking slightly diseased bulbs in a fungicide would kill the mycelium present ; it certainly would not kill thick-walled chlamydospores or resting-spores.

(2) Infected soil. Whenever a crop of diseased bulbs has occurred, it may be concluded with certainty that the soil is infected, due to the decay of bulbs before lifting, and to fallen diseased leaves, both of which contain chlamydospores in their tissues. So far as is known at present, the fungus has only been met with on Narcissus bulbs, but most probably in course of time, it will extend its ravages to other bulbous plants. Under the circumstances, the safest course would be to avoid planting bulbs for two or three years on land that had produced a diseased crop. No kind of dressing would be likely to destroy the chlamydospores directly, but during the spring, when they are germinating and producing secondary-



A Disease of Narcissus Bulbs (*for description, see text*)

spores, the latter would be killed by a dressing of kainit, or of sulphate of potash, lightly worked into the soil.

The disease is known in Holland, from whence, quite unintentionally, it may often be re-introduced into this country by means of slightly infected bulbs.

DESCRIPTION OF THE PLATE.

1. Section of Narcissus bulb, showing early stage of disease Natural size
2. Branched mycelium bearing clusters of Fusarium spores. × 400.
3. Chlamydospores or resting-spores. × 400.
4. Chlamydospores germinating and producing secondary spores. × 400.

Poisoning by Rhododendrons.

A CASE has recently been brought to the notice of the Board in which the loss of several cows has been attributed to poisoning by *Rhododendron ponticum* and its hybrids. The literature points to there being no doubt as to the poisonous character of a number of species of Rhododendron, and indeed most species are suspected. Animals do not appear to eat Rhododendrons very extensively, but both English and Belgian veterinary surgeons have published records of the poisoning of sheep and goats by *R ponticum*. Three cases of cattle-poisoning were recorded in the *Veterinary Record* (1900, 1906, and 1907); one of calves in the *Veterinarian* (1859), and three of sheep-poisoning—one in the *Veterinary Journal* (1906), and two in the *Veterinarian* (1865); but these cases were not all fatal.* Chesnut includes *R. Maximum* as one of the thirty poisonous plants of the United States.† According to Cornevin, *R. ferrugineum* causes frequent poisoning of animals which graze on the plateaux where it grows—especially sheep and goats, the latter providing the most victims, as they willingly browse the young shoots and leaves.‡

R. californicum is said to be poisonous to sheep in Oregon. *R. Chrysanthum*, the leaves of which have been used in Russia and Germany for rheumatism, have caused poisoning in man. *R. punctatum*, and *R. hirsutum* appear to be not less poisonous.

According to Eve (*Veterinary Record*, 1907), a reddish colour was observed in the milk of a cow poisoned by Rhododendron.

Both leaves and flowers are narcotic, and even the honey in the flowers is regarded with suspicion.

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* Lander, Veterinary Toxicology, 1913.

† U.S. Farmers' Bulletin No. 86, 1898.

‡ Des Plantes Vénéneuses, 1887.

"In these regions (Tungu) many of my goats and kids had died foaming at the mouth and grinding their teeth, and I have discovered the cause to arise from their eating the leaves of *Rhododendron cinnabarinum* ('Kema Kechoong,' Lepcha; Kema signifying Rhododendron); this species alone is said to be poisonous and when used as a fuel it causes the face to swell and the eyes to inflame, of which I have observed several instances." (Hooker, *Himalayan Journals*, ii., p. 150).

"*Rhododendron arboreum* becomes plentiful at 5,000 to 6,000 ft. (East Nepal), forming a large tree on dry clayey slopes. . . . In the contracted parts of the valley the mountains often dip to the river-bed in precipices of gneiss, under the ledges of which wild bees build pendulous nests looking like huge bats suspended by their wings, they are two or three feet long and as broad at the top whence they taper downwards, the honey is much sought for except in spring when it is said to be poisoned by Rhododendron flowers just as that eaten by the soldiers in the retreat of the Ten Thousand was by the flowers of *R ponticum*." (l.c., i, p. 200).

The leaves and flowers contain a bitter, poisonous principle, *Andromedotoxin*, which has been regarded as more poisonous than Aconitine Other substances found in Rhododendrons are *Ericolin*, *Arbutin*, and *Rhododendrin*, but it is not clearly shown whether these are poisonous when ingested; Kobert, however, includes the two former among cerebro-spinal poisons.

Lander's summary of the symptoms in a number of cases shows that cattle and sheep manifest intense pain, diarrhœa, discomfort, gritting of teeth, salivation, and frequently vomiting, while there is suppression of lactation, trembling, spasms, vertigo, loss of power, and death.

International Congress of Agriculture at Ghent.

THE following account of the proceedings of the Tenth International Agricultural Congress, which was held at Ghent in 1913, is based on an article by M. Henry Sagnier which appeared in the *Journal d'Agriculture Pratique*, and which has been utilised for this purpose with M. Sagnier's kind permission.

The work of the Tenth International Congress of Agriculture was subdivided into five sections:—(1) Rural Economy; (2) Agricultural Sciences and Education; (3) Animal Industry; (4) Rural Engineering, and (5) Forestry.

Rural Depopulation.—The programme of the section dealing with rural economy attracted considerable attention. This

was particularly the case in connection with the question of rural depopulation, which was the subject of an excellent report by Dr. Ernest Laur, director of the "Ligue des Paysans suisses." The conclusions which he submitted led to a long and animated discussion which was eventually closed by the adoption, with some modifications, of Dr Laur's conclusions. Briefly, these were as follows :—

The constant regeneration of the industrial population of the towns by immigration from the country is indispensable to the general prosperity of the people, and to hinder this immigration would certainly not be advantageous. It is obvious, however, that the emigration of the country population ought in no case to assume such proportions as to reduce the agricultural population below its normal level.

The system of small and medium-sized farms is that which gives the largest return from the soil and the largest economic revenue, but apart from this, it has the additional advantage of assuring a constant renewal of the life of the towns by the immigration of the surplus agricultural population.

The measures which Dr. Laur recommended should be taken to secure the maintenance of the rural population are .—

(*a*) The adoption of an agricultural policy favouring the formation of small holdings.

(*b*) The development of the technical side of agriculture by such means as agricultural education, experimental stations, distribution of information and advice, grants in aid of improvement of land, and of live stock breeding, etc.

(*c*) The encouragement of small holdings and the sale of produce by methods of agricultural organisation, etc.

(*d*) The prevention of insect and plant pests, insurance against damage done by hail, fire and accidents, insurance of animals, etc.

(*e*) The general encouragement by the State of measures favouring agricultural production.

Small Holdings—Resolutions were proposed by M. Jules Bénard with reference to the organisation of small holdings and were, after some dsicussion, adopted by the meeting.

These resolutions were to the effect that (1) The creation of small holdings is the best means of retaining men on the land ; (2) The quantity of land placed at the disposal of the agricultural labourer should be sufficient to attach him to the soil ; (3) Loans granted by mutual agricultural credit societies for the purpose of creating small holdings afford excellent security. and Governments should therefore encourage them by all

means in their power; (4) The object to be aimed at is to encourage the formation of small property which cannot be seized for debt, rather than small leasehold tenancies; (5) It is desirable to facilitate the rapid redemption of loans made for the acquisition of small holdings, especially by the reduction of the rate of interest.

M. Méline proposed the following resolution, which was adopted:—

"The Congress is of opinion that legislation in various countries should facilitate the transfer of land and that it should equalise as far as possible the conditions governing the transmission of real and of personal property, notably in connection with sales, rights of succession, and the procedure of partitioning."

Agricultural Co-operation and Insurance.—M. Rieul-Paisant presented a report on the general principles of agricultural co-operation and the best conditions for their application, while M. le comte L. de Vogué discussed the subject of mutual agricultural insurance in various countries. The conclusions thus arrived at were that the application of co-operation to insurance against agricultural risks is to be advocated both on account of its economic and moral effects, and that the intervention of the State in the functions of mutual insurance societies should be so regulated that the societies should not lose their true co-operative character.

Organisation of the Trade in Agricultural Produce.—In connection with this question it was pointed out that the difference between the price paid to the producer and that paid by the consumer often attains exaggerated proportions which justify legitimate protests, and that this state of affairs is common to all countries. M. Albert Henry, Secretary of the "Société centrale d'agriculture de Belgique," proposed certain resolutions in favour of public authorities endeavouring to take action with a view to the rational organisation of the trade in agricultural produce.

Agricultural Credit.—In a very interesting report M. le baron L. de Hennet described the functions of agricultural credit in different countries. After considerable discussion it was agreed that there is a pressing need for suitable systems of credit, and that agricultural credit is best secured by means of small mutual banks of limited extent, strongly grouped and controlled.

Agricultural Research.—In a very complete report, M. Toussaint examined the methods followed or to be followed in agricultural research. The principal discussion was relative

to the number of plots which should be used in a field trial. It was recommended that at least three plots should be used for each trial.

Agricultural Meteorology.—Under this head recommendations were made urging the desirability of agriculturists having some knowledge of scientific meteorology such as would enable them to interpret weather charts.

Among other subjects dealt with may be mentioned methods of selection, the cultivation of hops and the vine, and agricultural education, on each of which reports were read and discussed.

Value of Foodstuffs.—A discussion took place on the question whether the feeding value attributed to the principal feeding stuffs by Kellner corresponds with practical experience. Messrs. Gouin and Andouard reported to the Congress the results of their experiments with young cattle, and stated that they had come to the conclusion that the rations proposed by Kellner were excessive and too expensive. M. Nils Hannson and Dr. Charles Crowther stated their preference for the forage unit system adopted in Sweden and Denmark.

Selection and Breeding for Milk Production.—After hearing a report on this subject by Mr. Andrew Sloan the section came to the conclusion that external characteristics are not sufficient indication of the milking capabilities of a cow and that the milk record is the only reliable guide.

Destruction of Forests.—The steps that should be taken to prevent wasteful working or destruction of forests which are of value to the community at large formed the subject of several papers, and, after considerable discussion, resolutions to the following effect were adopted :—

(*a*) That the different States should lighten taxes which are imposed in relation to forests, and should encourage the conservation of forests and the production of full-grown trees.

(*b*) That the different States should encourage the acquisition of forest property by associations, etc., and should endeavour to extend the forest areas held by corporate bodies, and more especially those held by the State.

(*c*) That all forests, the conservation of which is of importance to the public, should be subject to systematic treatment ; and

(*d*) That the various countries should devise means to make private owners agree to a voluntary submission of their woods to the forestry regulations.

Other subjects dealt with were forest fires, and the low price of bark and underwood.

Artificial Immunisation of Swine against Swine Fever.

THE second interim report [Cd. 7247, price 4½d.] of the Departmental Committee of the Board of Agriculture and Fisheries on Swine Fever discusses the possibility of the extirpation of swine fever by artificial methods of immunisation.

Investigations in Holland and Hungary as to the methods in use in these countries were carried out by the Board's officers, and in addition to these the Committee considered the reports of enquiries into the same subject carried out in the United Kingdom by private investigators.

In Holland serum has been supplied free, on demand, to veterinary surgeons during the past two years, and results of some 6,000 inoculations appear to have been recorded. The method followed is to inoculate the pigs on infected premises with serum alone, relying on fortuitous infection to complete the process of active immunisation. This treatment is regarded as being still in the experimental stage. It is claimed that the use of serum reduces the number of deaths in the case of outbreaks Evidence was given that in certain districts swine fever is very prevalent, but precise information is not available, as the disease is not scheduled, and outbreaks are not officially reported.

In Hungary serum inoculation has been employed experimentally, in conjunction with isolation and restriction on movement, to a considerable extent. Experiments are now being commenced with simultaneous inoculation with serum and virus. In this country also it is claimed that the death rate on infected premises is reduced by the use of serum, but the statistics do not show any diminution of the prevalence of the disease.

The official reports from the United States of America show that serum inoculation has been employed much more extensively and for a longer period than in either Holland or Hungary, without effecting any reduction in the prevalence of the disease. The annual losses from swine fever have greatly increased, and appear to be still increasing. It is a matter of doubt whether the growing prevalence of swine fever may not be due to the spread of infection by inoculated pigs.

After consideration of the two methods of artificial immunisation : (i.) inoculation with serum alone, and (ii.) inoculation with serum, followed by natural or artificial infection with

the virus of the disease, the Committee formed the opinion that—

(*a*) Inoculation with serum alone affords too brief immunity to be of practical value ;

(*b*) Every known method of vaccination, or simultaneous inoculation with serum and virus, exposes the inoculated animal to risk and renders it infective to others ;

(*c*) Existing methods of inoculation do not promise assistance in the eradication of swine fever, though they might be serviceably employed in connection with a policy of control ,

(*d*) Further experiment is necessary with a view to finding a form of vaccination which will give active immunity to the inoculated animal without risk of further loss and dissemination of the disease.

Field experiments on serum and vaccination treatment are to be undertaken by the Board on infected farms.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Nitrate Contents of Arable Soils (*Journ Agric. Science, January, 1914; E J Russell, D Sc*).—The study of the fluctuations in the amount of nitrogen in the form of nitrate present in arable soils is important, both from the practical and the scientific point of view It has been satisfactorily proved in the past that nitrates are formed only from nitrites and these only from ammonia The present experiments were undertaken in order to compare the nitrate content of both cropped and fallow land The rainfall, temperature and soil moisture were taken into account in noting the results obtained The following conclusions were reached —

The amount of nitrate in the soil of arable land fluctuates regularly, but in these experiments it rarely exceeded the following values: In sand, 6 parts per million, or 28 lb per acre; in clay, 14 parts per million, or 60 lb per acre , in loam, 23 parts per million, or 115 lb per acre (except on heavily dunged land, when it rose to 37 parts per million).

In almost all the soils examined the accumulation of nitrate took place most rapidly in late spring or early summer, though the rise in nitrate content does not set in immediately the warm weather begins After this period there is usually little if any gain, and very frequently a loss

During the winter loss of nitrate takes place. This appears to be due to leaching and not to denitrification, and it was especially marked in the wet winter of 1911–12.

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

With regard to cropped and fallow land, it was found that during the late summer and early autumn the fallow land is the richer even after allowance has been made for the nitrate taken up by the crop The question thus arises whether the growth of a crop exerts any effect on the rate of nitrate production in the soil, but the data obtained do not permit a definite conclusion on this point.

Nitrogenous Manures (*Jour Dept of Agric and Tech Inst for Ireland, Jan*, 1914) —Nitrate of soda, sulphate of ammonia, calcium cyanamide and nitrate of lime have now been tested by the Department on various crops for five years The manures have been applied to oats, potatoes, turnips and mangolds along with other manures, and in such quantity as to supply equal amounts of nitrogen.

The results over the five years show calcium cyanamide and nitrate of lime to be quite equal to sulphate of ammonia and nitrate of soda in their effects.

On account of the greater difficulty in the handling and storage of the two new manures compared with sulphate of ammonia and nitrate of soda, the Department does not advise their use unless they are substantially cheaper per unit of nitrogen.

FIELD CROPS.

Manuring of Meadow Hay (*Jour. Dept. of Agric. and Tech Inst. for Ireland, Jan*, 1914) —The series which was commenced by the Department in 1901 in order to compare artificials with farmyard manure, and complete with incomplete dressings of artificials, has now been concluded after 13 years' work at 217 centres in all parts of Ireland The experiments have generally been conducted on permanent meadow land of average quality, such as might be expected to respond to the judicious application of manures.

The points that have been brought out most clearly are —

(1) That a dressing of 10 tons of farmyard manure per acre usually gives a substantial increase in the crop. The averages for the whole 13 years show, however, that if the hay crop is charged with the whole cost of the manure (4*s*. per ton) a loss of 13*s* per acre is incurred; but, on the other hand, if only half the cost is charged, a profit of 7*s*. per acre is obtained Further, the increase in the weight of hay does not fully represent the beneficial effects of an application of dung. Farmyard manure has a lasting influence, and subsequent crops derive considerable benefit from a previous dressing.

(2) Although the application of nitrate of soda alone gave a profitable return on the average, it is not recommended that this manure be used alone for meadow hay, unless in exceptional circumstances. Such a practice is calculated, in a comparatively short time, to cause deterioration in the quality of the produce by encouraging the growth of the coarser grasses to the exclusion of the finer plants

(3) The application of nitrate of soda and superphosphate gave varying results; the average figures show a considerable profit, but at many centres a loss resulted. This manurial dressing cannot, therefore, be regarded as so generally satisfactory as a complete mixture of artificials.

(4) The most satisfactory results and the highest average profit (14s. per acre) were obtained from the complete dressing of artificials, viz., 1 cwt. nitrate of soda, 2 cwt. superphosphate and 2 cwt. kainit per acre. Experience has shown that the full return from these

manures is not obtained in the hay crop, for the most marked improvement is noticeable both in the quantity and quality of the aftermath where they have been used. The superphosphate and kainit should be applied before the end of February; the nitrate of soda should be applied separately, at the end of March or early in April

Supplementary tests to the above series were carried out in 1912 and 1913 to compare basic slag with superphosphate. The results obtained up to the present tend to show that the two manures are of equal value for meadow hay when used in conjunction with nitrate of soda and kainit Basic slag gave slightly better results in the wet season of 1912 than in the dry summer of 1913, which may be an indication that the immediate effects of a spring application of this manure to meadow hay are realised to the greatest extent in a wet season

Liquid Manure—The application of 16 tons of liquid manure per acre has given slightly better yields of hay in each of the years 1911, 1912 and 1913 than either 16 tons of farmyard manure or a mixture composed of 1 cwt nitrate of soda, 2 cwt. superphosphate and 2 cwt. kainit The returns from individual centres showed rotation hay composed largely of Italian rye-grass to respond particularly well to applications of liquid manure. Equally good returns have been obtained from applications to meadow hay in both wet and dry seasons.

Manuring of Grass Land (*Univ. Coll Reading, Bull. XV., Manuring of Grass Land in Oxfordshire,* 1909-12; *G. R Bland, N.D.A., N.D D*)—The experiment has been carried out at several centres on different soils in Oxfordshire since 1909 The object was to ascertain the effect of the more important artificial manures when used singly and in combination on the quality and quantity of the herbage. The bulletin gives, for each centre, an analysis of the soil, yield of hay, analysis of the herbage and the financial results of the treatment

The analyses showed most of the soils to be deficient in available phosphates and potash.

Taking the average results of the three years at all centres, the most profitable treatment was the complete dressing of nitrate of soda, basic slag and kainit, basic slag and kainit without nitrate of soda giving the next highest profit. Nitrate of soda was a failure except in a few instances, but, as was to be expected from the soil analyses, slag and superphosphate did very well, improving the quality of the herbage in addition to increasing the yield of hay.

Suggestions are given for the manuring of various kinds of grass land in Oxfordshire

Manuring of Linseed (*Deut. Landw Presse, Feb. 4th,* 1914)—An early variety of linseed was grown on a loam soil after oats. The manures tested were various combinations of basic slag at the rate of 446 lb per acre, kainit at 446 lb per acre, and sulphate of ammonia at 89 lb. per acre The highest yields, both of seed and flax, and the greatest profit (viz, nearly £5 per acre increase over the unmanured plot) were given by the complete dressing of all three manures. The combination of basic slag and sulphate of ammonia gave the next highest yields and profit, followed by kainit and sulphate of ammonia, with basic slag and kainit last. All dressings gave profits. The length of stem averaged as follows:—Unmanured plot, 27 in.; slag, kainit, and sulphate of ammonia, 41 in.; kainit and sulphate of ammonia, 35 in.; basic slag and sulphate of ammonia, 35 in.; and basic slag and kainit, 31 in

A Russian Method of Corn Cultivation (*Deut. Landw. Presse, Feb. 11th,* 1914).—Particulars of this method of corn cultivation together with the results of tests carried out by various experimenters have been given in this *Journal* from time to time (see Dec., 1909, p. 740, Feb, 1911, p. 932, July, 1911, p. 330; and Jan., 1912, p. 857).

The present experiment was conducted in Bohemia during 1913 with oats on a light, well-drained loam. The quantity of seed used per acre was, by the ordinary method, 149 lb, and by the Russian method, 108 lb Earthing up was carried out on May 15th, and the resulting improvement was very noticeable on June 5th. The yields per acre were, by the ordinary method, grain 2,333 lb., straw 2,641 lb; by the Russian method, grain 2,748 lb, straw 2,936 lb. The value of the increased yields and the saving in seed from the Russian method was 27*s*. per acre. No account is given of the cost of extra labour.

LIVE STOCK AND DAIRYING.

Manuring of Grass Land for Milk (*Harper Adams Agric Coll, Report,* 1912)—In 1911 three plots of 3½ acres each were fenced off in a poor field which had received no manure for some years, and had been grazed by stock Each plot was drained and given a dressing of 15 cwt of ground limestone per acre Plot I then received 2½ cwt of superphosphate, and Plot II 2½ cwt of superphosphate and ½ cwt of sulphate of potash, while Plot III received no manure. In February, 1912, the plots were again dressed with these manures, applied at the same rate.

Six cows were then selected and divided into three lots of two each, as nearly equal in milk yield, period of lactation, etc, as possible These cows were turned out on the plots on April 29th. Milking was done by the same men in the morning and afternoon.

By May 30th it was evident that Plots I. and II. were capable of maintaining more than the two cows, and two yearlings were added to each of these plots On July 3rd for the same reason two bullocks were placed on each of these plots On August 5th the yearlings and bullocks were taken off Plots I. and II, and the four bullocks were placed on Plot III., where they stayed until August 24th The milk cows on each plot received 2 lb of undecorticated cotton cake per head per day, but the yearlings and bullocks received no extra food On September 16th, after 20 weeks' grazing the dairy cows were removed

The yield of milk for the 20 weeks was, for Plot I, 659 gall, Plot II, 604 gall, and Plot III, 550 gall The milk was valued at 5½d per gall. for May, June and July, 6*d*. for August and 6½*d*. for September On Plots I and II. the two yearlings were kept for 9 weeks 2 days, and taking the average value for grazing at 1*s*. 3*d*. per week for such stock, both plots are credited with 11*s*. 7*d* The four bullocks were bought for this experiment, and subsequently sold, their actual net gain being worth 5*d*. per lb. The returns, therefore, are:—

Plot I.—2 bullocks during 5 weeks gained—
1 cwt 1 qr 26 lb. at 5*d*. .. .. £3 9*s* 2*d*.
Plot II.—2 bullocks during 5 weeks gained—
1 cwt. 2 qr 10 lb at 5*d*. .. .. £3 14*s*. 2*d*.
Plot III.—4 bullocks during 3 weeks gained—
1 cwt. 0 qr. 14 lb. at 5*d*. .. .. £2 12*s* 6*d*.

The results of the experiment are, therefore, as follows :—

	Plot I.	Plot II.	Plot III.
	£ s. d.	£ s d.	£ s. d.
Milk yield	15 7 0	14 5 3	12 18 3
Grazing (Yearlings)	11 7	11 7	—
,, (Bullocks)	3 9 2	3 14 2	2 12 6
	£19 7 9	£18 11 0	£15 10 9
Cost of Manure	8 3	14 0	—
Total profit ..	£18 19 6	£17 17 0	£15 10 9
Profit per acre ..	5 8 5	5 2 0	4 8 9

Milking Machine Tests (*South Dakota Agric Exp. Sta , Bull No.* 144). —Trials of milking machines have been carried out over two and a half years Two Hazelwood machines were used, each capable of milking two cows at a time, and were worked by a gasoline engine. The following conclusions were reached .—

The machines gave very little mechanical trouble in operating, and with care this type of machine can be successfully and profitably used on a farm having at least 20 cows.

In general, little difficulty was experienced in getting the cows accustomed to the milking machine. The operator should study the individuality of each animal

It is best to strip the cows at once after the teat cups are detached to make sure that no milk remains.

These experiments appear to indicate that if the machine and cows are properly handled, the amount of milk and fat is not materially affected by machine milking.

The milk drawn by the machine was free from sediment, but it contained more bacteria than did the milk drawn by hand This was found to be chiefly due to the impure air drawn into the machine from the cow shed The bacterial content of the milk may be greatly reduced by filtering the air by means of cotton filters.

A 5 per cent. solution of calcium-chloride saturated with sodium chloride is recommended for cleansing the tubes and cups after use.

Feeding Experiments with Lambs (*Colorado Agric. Expt. Sta , Bull.* 187 , *G. E. Morton*) —These experiments were carried out over three winters to test the relative merits of various methods of feeding lambs. The following conclusions were reached :—

The saving effected by the use of self-feeders was found to be sufficient to cover the initial cost of the feeders within three seasons. It was observed that the distance between rack openings on opposite sides of the rack must not be too great or a pillar of uneaten hay will remain, preventing the hay above from slipping down to where the sheep can reach it; also it was noticed that the slope of the sides must not be too great or the hay will jam at the bottom.

A plump full-kernelled barley is as good as maize, pound for pound, for fattening lambs, when fed with lucerne hay. Light-kernelled,

heavy-hulled barleys are not so valuable as the two or four-rowed varieties.

The use of cut hay appears to be cheaper than whole hay, but this is chiefly found to be the case with poor hay which otherwise would not be entirely consumed by the lambs; in the case of good hay the saving effected is exceeded by the cost of cutting the hay, estimating this cost at 4*s*. per ton

HORTICULTURE.

Manuring of Hops (*Hop Manuring Experiments, Report for* 1913, *Dr. Bernard Dyer*) —These experiments have now been carried on for eighteen years at Golden Green, Hadlow, Tonbridge, on "Fuggles" hops, the garden being old hop ground, replanted, however, in 1894. In 1895 all the plots were limed and dunged. The manures used and the results in 1913, 1912, and the eighteen years are shown in the following table:—

Plot.	Annual Manuring per Acre.	1912 Crop.	1913 Crop.	18 Years' Average, 1896-1913.
		Cwt.	Cwt.	Cwt.
A	Phosphates and potash ..	9¾	7¾	10¼
B	Phosphates, potash, and 2 cwt. nitrate of soda	12	10¾	13¼
C	Phosphates, potash, and 4 cwt nitrate of soda	19½	15	15¾
D	Phosphates, potash, and 6 cwt. nitrate of soda	19¾	15	15½
E	Phosphates, potash, and 8 cwt nitrate of soda	23	15½	16¾
F	Phosphates, potash, and 10 cwt nitrate of soda	22	15½	16½
X	Thirty loads (15 tons) London dung	18	14¾	15

The phosphates used have been superphosphate and basic slag in alternate years, the dressings being usually 8 cwt. to 10 cwt. per acre; and the annual potash dressing has been 2 cwt. per acre of sulphate of potash or its equivalent in other potash salts The nitrate of soda has usually been applied in monthly dressings of 2 cwt., the first being given in January

The value of the 1913 crop ranged from about £9 5*s* to £10 per cwt. During the eighteen years there has been no regular or consistent difference in value between the produce of the various plots, so that it may be taken that hops manured with purely chemical manures have not been inferior to those grown with dung alone.

It is concluded that even when the soil is otherwise liberally manured by autumn or winter dressings of dung, rape dust, fish guano, etc., 4 cwt. per acre of nitrate of soda applied early in the spring may be regarded as a safe and profitable dressing for hops, even in a wet season; phos-

phates, of course, being used liberally at the same time, and also potash salts if the land requires potash. In the case of freely growing hops like "Fuggles," even 6 cwt of nitrate per acre may sometimes be used under such conditions, but this will depend upon the nature and quantity of the other nitrogenous fertilisers. In any gardens, however, in which neither dung nor any other nitrogenous fertiliser has been recently applied, there appears to be no reason to anticipate that 6 cwt. of nitrate per acre would be otherwise than safe, even for delicate varieties of hops (phosphates and, where necessary, potash also being applied); while for freely growing and heavily cropping varieties as much as 8 cwt. per acre of nitrate might be used There appears to be no advantage, even in the absence of all other nitrogenous manures, in exceeding 8 cwt. per acre

The nitrate of soda should not be applied late in the season

Pollination of Cherries (*Oregon Agric. Coll Expt Sta, Div. of Hort., Bull* 116).—The problem of cherry pollination in Oregon has, it is stated, recently become acute owing to the formation, during the last few years, of orchards varying from 10 to 100 acres in size, and composed in some cases exclusively of one single variety. In some instances these large orchards have been formed of two or three varieties and still without any very satisfactory results as regards setting of fruit.

The investigations recorded in this Bulletin were carried out in 1911, 1912 and 1913, and had reference to the varieties Bing, Black Republican, Black Tartarian, Coe, Early Purple, Elton, Knight, Lambert, Major Francis, May Duke, Napoleon, Rockport, Waterhouse, Willamette, Windsor, and Wood, all of which were found to be self-sterile This self-sterility was in no case due to a lack of germinability of the pollen produced; the pollen of each of the varieties was capable of producing a set of fruit on the variety or varieties with which it is inter-fertile

Certain of the varieties, notably Bing, Lambert, and Napoleon, the three leading varieties in Oregon, were found to be inter-sterile.

Of the above list, the most efficient pollenizers found were Black Republican, Black Tartarian, and Waterhouse, but other good pollenizers were Elton, Wood, Coe, Major Francis, and Early Purple

According to these investigations at least some members of the Duke group of cherries are capable of pollinating some of the Bigarreaus; and at least some of the varieties of the sour cherry (*P. cerasus*) are capable of pollinating some of the Bigarreaus.

It was found that inter-sterility of varieties of the sweet cherry was not apparently correlated with their closeness of relationship.

WEEDS AND PLANT PESTS.

Eelworms in Narcissus Bulbs (*Jour. Dept. of Agric. and Tech. Inst for Ireland, Jan.*, 1914; *T. R. Hewitt*).—The object of these experiments, carried out from October, 1912, to November, 1913, was to find whether infection can take place from infected to healthy Narcissus bulbs in the soil, to determine the mode of entrance of the eelworms, to discover a method of killing the worms without injuring the bulbs, and to find a preventive against attacks by eelworms in the soil.

Bulbs were soaked in different solutions for different intervals. The solutions used were formalin, 5 per cent. and 10 per cent.; copper sulphate, 5 per cent., 7½ per cent. and 10 per cent; cresylic acid,

2 per cent.; and undiluted paraffin. The bulbs were then cut and material from all damaged parts was examined in order to ascertain if the worms had all been killed; in the event of this not being the case a number were planted to see whether they could infect healthy unsoaked bulbs. Duplicate plots were planted with soaked healthy bulbs mixed with unsoaked infected bulbs to find if the solutions would prevent contamination

The conclusions reached are as follows: Copper sulphate in 10 per cent. solution injures the bulbs, so that it cannot be recommended The 7.5 per cent. solution does not injure the bulbs much, and the 5 per cent. solution hardly at all. Apparently the latter is as effective as the stronger solutions in killing the worms and penetrates more readily. The bulbs were soaked in this weak solution for 7 and 17 hours, but its application for a longer period might give a more satisfactory result, without the risk of injuring the bulb

It might be advisable to soak the bulbs soon after they have been lifted in spring; this might prevent migration, and probably would not injure the bulbs very much Copper sulphate is a good preventive against the attacks of insects, as well as of eelworms, and prevents, to some extent at least, the migration of pests from bulb to bulb

Formalin does not kill the worms as quickly as does copper sulphate, and it is of no value as a preventive, it does not injure the bulbs in any way.

Cresylic acid does not mix well with water nor penetrate the bulbs, and cannot be recommended. Paraffin completely kills the bulbs, and should not be used

Migration and infection can take place in the soil, but only during the summer months when the bulbs are in a dormant state, and the conditions are more suitable for the activity of the worms Apparently there is a large mortality among the worms during the winter, wet and cold being adverse to their requirements. There can be no doubt that the worms migrate and carry on their ravages much more quickly amongst stored bulbs than in those planted, but there is danger of contamination in the soil as well as in storage

The mode of entrance is, as observed by Continental writers, by the crown; the worms work their way down between the scale leaves, finding better pabulum at the base, and very soon ruin the bulb

Destruction of Sheep's Sorrel (*Field Expts at Harper Adams Agric. Coll., Report* 1912)—In the course of experiments on wart disease of potatoes, some plots of land were treated with lime and gas lime Each dressing was applied at the rate of 5, 10, and 15 tons per acre respectively. As the plots were infested with Sheep's Sorrel, the effect of the dressings on this weed were carefully noted

The results showed that both lime and gas lime applied up to 10 tons per acre were effective in suppressing the weed, gas lime giving rather the better results There appeared to be no additional advantage in a heavier application than 10 tons per acre There is every evidence that systematic liming is the best method of dealing with Sheep's Sorrel.

NOTES ON AGRICULTURAL CO-OPERATION.

Calne Pig Insurance Association.

THE parish of Calne, in Wiltshire, with a population of over 5,000, had a total acreage under crops and grass in 1912 of over 8,000 acres, of which some 6,500 acres were under permanent grass, and 1,500 acres under crops. The land was held in about 130 agricultural holdings of above one acre, of which about 90 were under 50 acres in area. There were 1,500 pigs in the parish, including 105 sows kept for breeding.

The town of Calne is a centre of the bacon-trade, and the large bacon-factory of Messrs. Harris & Co maintains a constant demand for well-bred pigs The best prices are paid for pigs which are not over-fat, say from 6½ to 8½ score (130 to 170 lb.) dead-weight. Such pigs would generally be about six months old when slaughtered, and, at the present price of about 11*s*. per score, would be worth from £3 10*s*. to £4 15*s* This steady demand has led to the extension of the pig-fattening industry among the population generally, and especially among the working-men, many of whom buy a number of young pigs at a time, fatten them as quickly as possible, and send them to the factory, after having had them in their possession only 3 or 4 months. One labourer, for example, bought 7 pigs in January, 6 in February and 10 in September—23 in all, another had 29 pigs pass through his hands in the course of a year. This forms a great contrast to the conditions under which most of the other pig clubs in England have been established, consisting as they do largely of working-men, who have only 1 pig at a time in their possession, and who keep it for 8 or 10 months and kill it for their own consumption.

At Calne in 1911 the 67 members of the pig insurance society insured 728 pigs, an average of nearly 11 pigs per member: for 31 other societies in England the average number of pigs insured per member was only 1.7 At Calne in one year one member insured 58 pigs, and another 46.

In 1906 a number of the pig-owners of Calne and its neighbourhood started and registered under the Friendly Societies Acts the "Calne and District Pig Insurance Association," with the object of affording "means by which members may upon strictly mutual principles insure against loss of their pigs through disease, accident or other cause." Dealers who buy and sell pigs or other animals for a livelihood, are excluded, but all other persons residing within a radius of 6 miles from the Calne Town Hall may become members In the first year the number of members was only 12, but it has now mounted up to 60. Most of the members are working-men, but the Society includes a number of gardeners, masons, painters and engine-drivers, as well as a coal-merchant, a schoolmaster and a solicitor It is managed by a committee of 10, which is elected by the members, and is at present composed mainly of working-men, but includes a small-holder, and a coal-merchant, who is chairman.

A member on admission to the Society pays an entrance fee of 6*d*, and thereafter pays an annual subscription of 1*s*. 6*d* The fees and subscriptions, as well as 10 per cent. of all premiums received and miscellaneous income from interest, fines, &c, are carried to a management fund, from which are defrayed the expenses of management. These expenses for five years averaged nearly £7 10*s*. a year,

including £5 paid as salary to the secretary: while the total income of the fund averaged about £10 a year, so that the management fund at the end of 1911 showed a balance at credit of £23, but since then a sum of over £19 has been transferred from the management fund to the insurance fund, and the balance to the credit of the former fund at the end of 1912 was £3 7*s*. 4*d*. In the latter year the income was £6 8*s*. 8*d*. including £4 7*s*. from annual subscriptions, and £2 0*s*. 2*d*. from the 10 per cent. on the premium receipts, while the expenditure was £7 2*s*. 11*d*, so that it seems probable that in future the management fund, taken by itself, will show no large balance either way.

For insurance purposes, pigs are divided into three classes, (1) store-pigs which are being fed for bacon or pork, (2) sows intended to be kept for breeding purposes, and (3) boars intended to be kept for stud purposes. The number of pigs insured, which in 1907 was 493, rose in 1911 to 728, of which 714 were store-pigs and 14 breeding-sows, and fell again in 1912 to 391 (including three breeding-sows). This sudden drop is said to have been due to the serious drought of 1911, when the cost of all food-stuffs rose to such an extent that there was very little, if any, margin of profit in keeping fattening pigs. During the last seven years the Society has insured only one boar, which survived its year of insurance: it insured on the average 10 sows, of which, altogether, 4 died, giving an average death-rate per annum of 5½ per cent This is a high death-rate compared with that of other pig clubs, but as the premium income from sows amounted in the seven years to £17 15*s*, while the total sum paid by the Society on sows that died came only to £10 0*s*. 2*d* (an average of £2 10*s*. per sow) there is, so far, no reason to think that the premium charged per sow, which, like that for boars, is 5*s*. per annum, is too low. The Society is liable to pay not more than £5 on any one sow or boar, and only insures animals above seven weeks old.

Much the most important class is that of store-pigs, and the statistics regarding them may be examined in more detail. They are as follow:—

Year.	No. of store-pigs insured.	No. on which claims were paid.	Death rate per cent. per annum.	Amount paid on claims. £	s.	d.	Amount received in premiums. £	s.	d.
1906	47	—	—		—		2	6	0
1907	493	20	4.1	16	1	2	24	13	0
1908	434	14	3.3	16	9	8	21	10	0
1909	339	11	3.2	12	9	0	16	19	0
1910	606	36	5.9	45	4	6	30	6	0
1911	714	54	7.6	51	4	0	35	14	0
1912	388	11	2.8	9	14	0	20	3	0
Average for six years.	495	24.3	4.9	25	3	9	24	17	6

Thus, on the average of six years, the death-rate among store-pigs insured was 4 9 per cent per annum, and the amount paid by the Society averaged £1 0*s*. 9*d*. per pig that died, and slightly exceeded the premium income, which was 1*s*. per pig insured. But, as already said, 10 per cent. of this premium income is carried to the management fund, so that the net amount available for the insurance

fund is less than 11*d*. per pig insured. Thus the insurance fund for store-pigs was run at a loss of £15 for the whole period of six years, and it was found necessary to draw on the balance at the credit of the management fund to keep it solvent

Putting both insurance fund and management fund together, the net assets of the Society, which had gradually risen to £41 19*s* 8*d*. in 1909, fell to £9 11*s*. 11*d*. in 1911, but again improved in 1912 to £17 6*s* 6*d*

The chief reason for the falling off in the net assets was that the death-rate for store-pigs had begun to increase at an alarming rate For the first three years after the Society started, the average death-rate was only 3.6 per cent per annum, which is not high when compared with the average death-rate of 4 2 per cent for the 31 registered pig clubs in England in 1911, but in the two years, 1910 and 1911, out of 1,320 pigs insured no fewer than 90 died, a death-rate of 6 8 per cent The very high death-rate of 7 6 in the latter year may have been due to the exceptionally dry, hot summer, which was trying for fat pigs In 1912, however, the Society succeeded in reducing its death-rate to the low figure of 2 8 per cent., a change which at once showed its effect in an improvement in its financial position.

Scheme for Encouraging Improvement in the Breeding of Cattle.

The Lords Commissioners of His Majesty's Treasury have agreed, on the recommendation of the Development Commissioners, to make a grant to the Board of Agriculture and Fisheries from the Development Fund in aid of the improvement of cattle in England and Wales

The main object of the scheme is to afford means of demonstrating to groups of farmers, especially the small farmers, that it is sound economy and of pecuniary advantage to use only sound and high-class sires Preference in the assistance contemplated is to be given, as far as possible, to occupiers of agricultural holdings which either do not exceed 100 acres in extent or, if exceeding 100 acres, are of an annual value for purposes of income tax not exceeding £100

The assistance will take the form of financial help for the provision of high-class bulls at the same low fees as are usually paid for the use of an inferior type of sire

It is prescribed by the conditions attached by the Development Commissioners to the grant that, wherever possible, the provision of bulls is to be made through the medium of Societies, which may either be already in existence or be specially formed for the purpose, as the Commissioners consider that the formation of Societies will afford the best means of enabling small farmers to realise the advantages of co-operating, and of securing thereby the services of high-class sires, which as isolated individuals they might not be able under existing circumstances to obtain. It is recognised that in some districts it may not be possible at once to form Societies for the provision of bulls, and where this is found to be the case, grants may be offered to individual breeders who are willing to place approved bulls at the disposal of their neighbours.

It is not intended, however, that the offer of grants to individuals for the provision of bulls shall be continued for so long a period as that of grants to Societies.

Conversion of Scheme into System of Loans after 1918–19.—The Development Commissioners wish it to be understood that the scheme will be converted at the end of 1918–19 into a system of loans to Societies, unless it then appears that the purpose in view has not been attained, and that all grants or loans for future years are subject to the general conditions (*a*) that the working of the scheme is satisfactory, (*b*) that in the opinion of the Commissioners the financial position of the Development Fund warrants the expenditure

Live Stock Officers.—Live Stock Officers, attached to selected Agricultural Institutions, have been appointed and they will be primarily responsible for the local promotion and administration of the Live Stock Scheme in the areas for which they are appointed.

Memorandum as to Grants for Bulls.

1. Grants for bulls will be made preferably to a Society which has been formed for the purposes of the scheme, provided it adopts rules which conform substantially to those issued by the Board.*

2. Grants may also be made to an existing Society which encourages improvement in the breeding of cattle by the provision of high-class bulls or is prepared to do so, provided that—

(*a*) The existing rules of such a Society are approved by the Board or are amended as may be required by the Board.

(*b*) The grant is utilised for developing the scope of the operations of the Society by the provision of other or higher class bulls, or by some other means approved by the Board

3 A Society whose operations are not confined solely to the provision of bulls shall be required to keep a separate account of all income and expenditure in respect of any grant made to them by the Board for the provision of bulls

4 A Society may provide a bull for the use of its members—

(*a*) By purchasing a bull and placing it in the custody of one of its members

(*b*) By arranging with an owner of a bull—whether he be a member of the Society or not—to place a bull at the disposal of the Society on terms agreed between them

5. If a Society arrange to purchase a bull it will be necessary to provide, by means of contributions from Members, or donations to the Society, sufficient capital to defray the cost of the purchase of the bull, and also an annual income sufficient to cover (1) the expenses of the Selection Committee of the Society, (2) the insurance of the bull against death, (3) the insurance of the Society and custodian against damage by the bull, (4) the payment to the custodian for the keep of the bull, (5) the salary of the Secretary of the Society, (6) the general expenses of management, and (7) sinking fund charges in respect of the depreciation of the bull sufficient to provide for the replacement of the bull when necessary.

These charges would amount approximately to an annual expenditure of £20 in the case of a bull which is purchased for £50 and sold after three years for £20.

6 If a Society arrange with an owner of a bull to place a bull at their disposal they must guarantee the service of not less than 25 cows belonging to their Members.

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* The Model Rules issued by the Board, together with detailed Regulations as to the award of grants, may be obtained free of charge on application.

7. The owner of a bull will be entitled under these circumstances (1) to a payment from the Society of a sum not exceeding £12 as may be agreed upon, (2) to a fee of not less than 2*s*. 6*d*. for each cow served, and (3) to have not more than 15 of his own cows served by the bull.

8. If a Society arrange for the provision of a bull in this manner, the grant of £15 made to them by the Board, together with a nominal subscription of, say, 1*s*. a Member, would probably suffice to defray all expenses, as the owner of the bull and not the Society will be responsible for the keep, insurance, and care, &c. of the animal.

Grants for the provision of bulls will be made on the following conditions:—

(1) No grant exceeding £12 per annum is to be made to any individual bull owner, or exceeding £15 per annum (inclusive of £3 for general expenses) to any Society in respect of each approved bull provided.

(2) The full annual grant per bull of £12 to individuals and £15 to Societies will not be continued for more than four years in the case of individuals and five years in the case of Societies.

(3) Grants are only to be made to individuals when the Live Stock Officer in the area concerned is satisfied after full inquiry that it is not possible to form a Bull Society for a district in which the provision of a good bull is necessary

(4) No grant is to be made to any individual in respect of a bull owned by him before this scheme comes into operation unless the Live Stock Officer is satisfied that in return for the grant the bull can and will be made available to an appreciably greater number of cows belonging to small farmers than it now serves

(5) Not more than one-third of the sum available for grants in any one year is to be spent in grants to individuals.

Model Rules for Heavy Horse Societies.

Model Rules for the conduct of Heavy Horse Societies have been issued by the Board of Agriculture and Fisheries, and copies may be obtained free of charge on application These Rules have been issued for the guidance of societies which have been formed for the purposes of the Board's schemes for the improvement of breeds of heavy horses. The regulations of the Board as to the award of grants to heavy horse societies are published with these Rules.

The Progress of Agricultural Co-operation in Denmark.

The following information as to the progress of the co-operative movement in agriculture in Denmark is given in a report for the year 1912, by H M. Consul at Copenhagen. (*F. O. Reports, Annual Series, No.* 5221.)

Co-operative Dairies.—The first co-operative dairy was started in Denmark in 1882. Now there are in all 1,177 co-operative dairies, with 154,602 members. About 2,580,000 tons of milk are annually treated, from which about 94,000 tons of butter are produced, representing a value of about £10,700,000. In 1909 the country's total number of cows was 1,282,254, of which 83 per cent., or about 1,059,956, belonged to farms delivering milk to co-operative dairies. About 10 per cent of the total number of cows delivered milk to private dairies; hence nearly nine-tenths of the country's total number of cows are to

be found on the farms which deliver milk either to co-operative or to private dairies.

Private dairies, of which there are 328, are owned by individuals or by companies who buy milk by contract from the farmers, whilst co-operative dairies are owned by the co-operating members themselves, in proportion to the number of cows for which they are booked. These members form in the same proportion a guarantee for the dairy's liabilities. As a rule, the members are bound to the enterprise for a period of 10 years

With reference to the quantity of milk produced, the Royal Statistical Bureau reports in 1909 an output of 3,345,000 tons. The average annual amount of milk per cow is (taken all the year round) about 5,664 lb. In general, the milk yield per cow is larger on the small farms than on others Co-operation is especially a movement among the owners of medium and smaller-sized farms

Large farms, or the "big estates," as they are often called, were, before the starting of the co-operative movement, considerably more advanced in all matters relating to dairy farming than the peasant farms, but when the co-operative dairies were started, the positions were reversed But as these co-operative dairies had a much larger number of cows than a single large farm, the large farmers either joined the co-operative dairies, or in some cases founded their own *Herregaards-mejerier* (large estates dairies)

Control Societies—The object of these societies is, amongst other matters, to report the quantity of butter fat contained in the milk, to keep a complete record, not only of the entire stock, but of each single cow, and to control the milking capacities of the cows. In 1895 the first society was founded, and by 1911 there were 521 societies. The general milking capacity per cow in the control societies, taken for the entire country, was 5,756 lb (Danish milk is usually reckoned by weight), whilst the corresponding figure for cows outside the control societies was 5,120 lb The difference was therefore 600 lb. of milk, corresponding to about 23 lb of butter annually, so that the controlled cows gave about one-eighth more milk than those not under the control. In this form of the co-operative movement the principal participants are the proprietors of medium-sized and large farms

Co-operative Bacon Factories—The first co-operative bacon factories were founded in 1887. There are 42 now working, and more are being started. The foundation and working capital is about £550,000. The co-operative bacon factories have 120,000 members, and in 1911 1,695,843 pigs were slaughtered, representing a value of £5,900,000, besides which certain of these bacon factories slaughtered cattle to the number of 28,000 last year (1911), representing a value of £150,000 Furthermore, there are some which also have a department for exporting eggs, this export rose in 1911 to the value of £162,268. The capital for starting the various Danish co-operative enterprises is raised by means of loans, which the members guarantee. This guarantee usually covers a period of 10 years, at the expiration of which time the liabilities are paid off, or at least have been brought down to so small a sum that the buildings with plant, &c., in any case represent a value amply sufficient to cover the remaining debt, should the members wish to withdraw. The co-operative members' obligations with reference to the number of pigs they are to supply, vary with the different bacon factories according to the manner in which the regulations are framed.

To some bacon factories the member must deliver a certain number of pigs agreed upon, whilst to others he is obliged only to send those he has suitable for bacon. The co-operative bacon factories fix every week a certain price, according to which the members get paid out in advance a certain sum, dependent on which class (first, second or third) the pig is judged to belong to. At the end of the financial year, after all expenses have been deducted from the assets, the accounts are brought forward at a general meeting, and it is decided what sum can be paid out, or what should be paid back, on the money advanced. At this general meeting every co-operative member has the right to one vote, and all matters that would not necessitate a change in the regulations and laws are simply decided by a majority of votes.

Every pig killed in Denmark for export is inspected by a veterinary surgeon appointed by the State, and under the control of the Department for Agriculture. Every pig in which the smallest sign of tuberculosis can be traced is refused for export as bacon. Those pigs suitable for export are branded with a mark in *red*, and this mark guarantees that the bacon is derived from completely sound animals.

With the help of breeding stations, which are under the control of the Department of Agriculture, the producers are continually endeavouring to improve the quality of the bacon, and to meet the requirements of the consumers in the United Kingdom

Exports of Eggs.—This branch of the co-operative movement first began to develop in 1895, when a Danish co-operative egg export society was founded It started local centres, of which there are now 500, introducing the branding system, and the strict regulations requiring members to deliver only clean new laid eggs for export Before the eggs are packed for export, they are submitted to examination by electric light, in order to ascertain their degree of freshness

Small Holdings.—Each of the 74,000 small holdings usually comprises an area of about 3 to 7 acres On a well-cultivated small holding there are usually a couple of cows, which produce annually about 7,930 lb of milk, representing a value of £19 Besides these some 10 or 12 pigs are kept for fattening, representing a value of £32 to £37 Some 50 or 60 fowls, capable of giving a yearly return of £8 10*s*., are also kept by the small holder, as well as two or three calves, which may give a profit of £3 4*s* per head. A small holding of the size mentioned may be reckoned to have a value of from £170 to £300, including the livestock No branch of Danish agriculture has reaped more profit from the co-operative movement than these small holdings, as they now receive the same payment for their milk and pigs as the large farms; consequently they have risen higher in value than other land. Not only the State, but agricultural organisation as a whole does much to help this class of farmer.

Co-operative Agricultural Credit in France in 1912.

While there are in France a considerable number of independent co-operative credit societies which receive no aid from the State, the great majority of societies of this character are provided with a large proportion of their working capital by advances from State funds. The Minister of Agriculture has recently presented a report on the working of these State-aided societies during the year 1912. The advances are made by the Government, free of interest, to Central Banks (*Caisses régionales*), of which at the end of 1912 there were 98,

the total amount of State funds then at their disposal being £3,435,000. The Central Banks in their turn make advances to the local societies affiliated to them, and the local societies are thus enabled to make loans to their individual members at a much lower rate of interest than they would have to charge if they had to obtain the necessary capital in the open market.

The Central Banks are allowed to advance money not only to societies formed for the purpose of making short-term loans, but also to co-operative societies formed for the production and sale of agricultural produce, and to individuals in the form of long-term loans, repayable by instalments spread over a series of years At the end of 1912 290 societies for production and sale, consisting of 37,000 members, had received advances amounting to £365,000, on which the rate of interest charged was generally 2 per cent These societies have been formed for the disposal of milk, butter and cheese, the production and sale of fruit, grapes and olives, and other similar purposes Long-term loans are made mainly to enable young men of the agricultural classes to obtain and work small holdings, on which they can bring up a family The total sum advanced for this purpose in the three years ending with 1912 amounted to £309,000, advanced to 2,049 peasants

In regard to the local credit societies formed for the purpose of making short-term loans to their members, these societies at the end of 1912 numbered 4,204, with 216,000 members, an average of 51 members per society They had a paid-up capital of £541,000, and during the year they made new loans to members amounting to £3,419,000, and recovered loans previously made to the amount of £3,291,000, the amount out on loan at the end of the year being £2,593,000 As they received advances of State funds at a low interest through the Central Banks—generally at 3 or 4 per cent—they were able to make advances to their individual members at rates varying from 3 to 5 per cent, and to pay interest to their shareholders at from 2 to 4 per cent Their reserve funds at the end of the year amounted to £113,000

OFFICIAL NOTICES AND CIRCULARS.

MEMORANDUM *of the Insurance Commissioners for England and for Wales on the* SPECIAL PROVISIONS *of the National Insurance Acts permitting a reduction of contributions in cases where* AGRICULTURAL *employers are liable to pay* FULL REMUNERATION DURING THE FIRST SIX WEEKS OF SICKNESS

National Health Insurance.

The following Memorandum relates to the application to agricultural employment of Section 47 of the National Insurance Act, 1911, which allows in certain cases the payment of a reduced weekly contribution, where the employer is liable to pay full remuneration during the first six weeks of sickness It has been prepared by the Commissioners for the assistance of agricultural employers who wish to pay contributions in accordance with the Section. The Memorandum relates only to England and Wales

1. The Section only applies to classes of employment which have been included in a Special Order made by the Commissioners under the Section.

2. The classes of agricultural employments which have (up to this date) been included in a Special Order are shown at the end of this

Memorandum. At present, no Orders have been made applying to women engaged in agricultural employment. Domestic servants (men and women) are included by a Special Order applicable in all areas, not only agricultural.

3 An employer who employs persons in any of the classes shown at the end of this Memorandum is not obliged to avail himself of the provisions of any such Special Order, but may do so if he chooses The employed person has no choice in the matter.

4 If an employer decides to take advantage of the provisions of such Special Order, he must give notice to the Commissioners of his desire to come under the Special Order A notice given to the National Health Insurance Commission (England) is operative only in respect of employees in England, and similarly with Wales.

5 The notice must be given by filling up and signing Form X27(a), which can be obtained from the Offices of the National Health Insurance Commission (England), Buckingham Gate, S W, or from the National Health Insurance Commission (Wales), City Hall, Cardiff, as the case may be When filled up it should be sent to the Office from which it was obtained.

6. The notice will in every case apply to every individual in the specified class who is employed by the person giving the notice, except to those who are employed at a rate of remuneration of less than ten shillings a week

7 Where the employer gives notice he renders himself liable as follows —

(i) *If the engagement is for less than six months certain,* he must pay to all his employees within the specified class *full remuneration** during sickness for a period not exceeding six weeks in any one year.†

If the illness commences while the employee is in his employment, the employer is liable to pay full remuneration for the period of the illness not exceeding six weeks in the aggregate in the twelve months, even though the employee may have left his employment before the expiration of that time

Broken periods of sickness occurring within the same twelve months will be reckoned together in calculating the six weeks for which the employer is liable.

(ii) *If the engagement is for not less than six months certain,* the employer's liability ceases when the employee leaves his employment, and he is not liable to make any payments for any part of the period of illness after the expiration of the term of engagement

The employer's liability, however, in this case extends to any period of illness lasting less than six weeks and to the first six weeks of any periods lasting more than six weeks, however many such periods there may be during the engagement The employer may thus in the aggregate be liable for more than six weeks in any twelve months

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* Remuneration includes board, lodging and allowances, of any kind, wherever given, or their money equivalent.

† It should be understood that the term "year" in this connection is to be interpreted as meaning any period of twelve months. In other words, an employer is only liable to pay full remuneration under the Section to an employee in respect of a given day of sickness if, *during the period of twelve months ending with that day,* he has, since adopting the provisions of the Section, paid him full remuneration thereunder for a period or periods amounting in the aggregate to less than six weeks. Any period of absence from work through illness (even if only for a day) counts as part of the six weeks.

8. Persons insured under the Section are not entitled to sickness benefit (*a*) for any period during which full remuneration is payable by the employer in discharge of his obligation under the Section, or (*b*) for the first six weeks of any period of disease or disablement *commencing* during temporary unemployment.

9. Nothing in the Section will relieve any employer from any legal liability to pay wages during sickness to any person employed by him in accordance with any established custom

10. The ordinary rates of contribution will, for persons included in the Notice, be reduced by 2d. a week, the employer's share of the contribution being reduced by 1d., and the share of the employee by 1d.*

11. Contributions will not be payable for any periods of illness during which full remuneration is payable under the Section The employer will be liable, when required by the insured person, to deliver to him and also, on the demand of his Society or Insurance Committee, to his Society or Insurance Committee, as the case may be, a statement in writing giving the dates of commencement and termination of his illness, together with a statement whether he did or did not perform any work for the employer during the whole or any part of the period of illness.

12. *The payment of contributions at the reduced rate authorized by the Section is conclusive evidence that the employer accepts liability to pay full remuneration during sickness, as provided by the Section*

13. The provisions of the Section will not apply to any persons whose rate of remuneration† is less than 10s. a week (*See para* 6 *above.*)

14 Every person in respect of whom contributions are paid at the reduced rate for which the Section provides should furnish to the Approved Society of which he is a member, or, if he is a deposit contributor, to the local Insurance Committee, such information as will enable them to deal with his case correctly in the event of a claim for sickness benefit being made.

15. *An employer who has given notice as explained above may, by giving notice not later than the 30th September in any year, withdraw such notice as from the following 1st January Where such notice is given, full contributions become payable and the liability imposed by the Section ceases as from the 1st January.*

AMONG THE CLASSES OF AGRICULTURAL EMPLOYMENT INCLUDED IN SPECIAL ORDERS UNDER SECTION 47 ARE THE FOLLOWING :—

England

16. Employment as any kind of farm servant under a contract of not less than six months' duration (male persons only) in Northumberland and Durham, Yorkshire (North Riding, N. and N.E. parts).

17. Employment as a farm servant in charge of animals (male persons only) in Berks, Cambs. (North), Dorset (E. and S.), Gloucestershire, Hants, Kent, Lincolnshire, Nottinghamshire, Oxfordshire, Rutland, Warwickshire, Wilts, Worcestershire, Yorkshire (E. Riding).

* In the case of women domestic servants the contribution is reduced by 1½d. a week, the employer's share being reduced by ½d., and the servants, share by 1d.

† Remuneration includes board, lodging and allowances, wherever given, or their money equivalent.

18. Employment as a farm servant (male unmarried persons only) in Cumberland, Westmorland, parts of Lancashire, namely, the hundreds of North and South Lonsdale, Amounderness, Leyland and Blackburn, Yorkshire (W. Riding)

19. Employment as a farm servant (male unmarried persons only) under a contract of not less than six months' duration, where the terms of service include board and lodging in the farmhouse, in Cheshire, Derbyshire, Hereford (West), Shropshire, Staffordshire.

Wales

20. Employment as a farm servant under a contract of not less than one year's duration (male unmarried persons only) in Wales

Outbreaks of Foot-and-Mouth Disease.

Since February 6th, the date referred to at the conclusion of the article in last month's *Journal*, the position with regard to foot-and-mouth disease has considerably changed.

On February 13th the disease was discovered in the Birkenhead Irish Animals Landing Place amongst animals which had been landed thereat from Ireland for the purpose of slaughter in the Landing Place under the Order of the Board, dated January 31st The Board thereupon made an Order the same day entirely prohibiting until further notice the landing in Great Britain of any cattle, sheep, goats or swine shipped from Ireland after that day This prohibition still (March 12th) remains in operation On March 1st the Board received information that the existence of foot-and-mouth disease had been officially confirmed by the Department of Agriculture and Technical Instruction for Ireland in the county of Cork, and a number of further outbreaks of the disease in the same district, and also in county Tipperary, have since been notified to them by that Department.

Four centres of foot-and-mouth disease have also been discovered in Great Britain since the issue of last month's *Journal*, viz , at (*a*) Low-fell, near Gateshead, co Durham, on February 19th , (*b*) Bradley Green, near Redditch, Worcestershire, on February 22nd , (*c*) in the city of Liverpool on February 23rd , and (*d*) Bodlondeb, Conway, Carnarvonshire, on March 4th The usual restrictions were at once imposed by the Board in each case prohibiting the movement of animals over a wide area surrounding the affected premises In each case in Great Britain, except that in Liverpool, the outbreak appears to have been an isolated one In Liverpool, however, five further outbreaks have occurred, all within the city. The Board have been able, up to March 12th, to make substantial modifications of the original restrictions in each area, and the Scheduled Districts in the Durham and Worcestershire areas have been considerably reduced

Restrictions imposed by Canada, Argentina and Jersey on the importation of English live stock were given in the *Journal* for December last, pp 827-8, and those imposed by the United States and Uruguay in the *Journal* for January, p. 924. Additional restrictions are:—

New Zealand.—The importation of Cattle, sheep and pigs from this country is prohibited.

Isle of Man.—The importation of cattle, sheep, goats and pigs from England is prohibited.

The Board have issued as No. 17 of the series of Miscellaneous Publications a Pamphlet on Manurial Experiments.

Manurial Experiments. Most of the experimental schemes contained in this pamphlet were originally drawn up in 1903 by the Agricultural Education Association It was hoped that they would be extensively carried out by the members of the Association, and others in different parts of the country, so that the results could be co-ordinated, and it would be possible to compare the action of definite quantities of manurial ingredients in different districts and on different geological formations, and also to formulate general rules as to the requirements of crops on different classes of soils This object has not been attained, as very few members of the Association have carried out experiments on the lines suggested, but the Board feel that it is highly desirable that a carefully designed series of simple experimental schemes should be available for reference both by private individuals and by public authorities They therefore reprint the Association's manurial schemes with some alterations and additions which it is hoped will make the object and details of the experiments more readily comprehended

It must be clearly understood that the object of the experiments is not to establish new principles or to ascertain the effect of totally new systems of treatment, but rather to supply the individual farmer with answers to questions which must inevitably occur to anyone concerned with the manuring of crops on some particular soil Special care has been taken to avoid any but broad and clearly-defined issues Too often, in carrying out field experiments, an attempt is made to distinguish between systems of treatment so similar that the differences introduced are overshadowed by accidental differences of soil, situation and cultivation, which it is impossible to avoid Where small differences are concerned the experiment must be repeated many times to obtain a result in which confidence can be placed.

Most of the schemes described in this pamphlet are of so simple a character, and are so direct and practical in their object, that they are capable of general adoption by farmers. Every farmer should be more or less an experimenter, and the results of the experiments described would indicate clearly the manurial requirements of his own fields

The Pamphlet may be obtained at the Office of the Board, Whitehall Place, London, S W , price *2d*, post free Letters so addressed need not be stamped

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Supplements to the "Journal." The following Supplementary Numbers to the *Journal* have been issued , some of these may be obtained free on application, and in the case of others the price is shown .—

No 1. Agricultural Education in the United States, January, 1908
No. 2. The Food of some British Birds, December, 1908
No. 3 Work of the International Agricultural Institute, April, 1910
No 4 Wheat Papers read at a Meeting of the British Association at Winnipeg, 1909, June, 1910
} Free, on application

No 5 Influence on the Production of Mutton of Manures applied to Pasture, January, 1911 Price *4d.*, post free.

No. 6. Report on the Work of the International Agricultural Institute, July, 1911 Free on application.

No. 7. The Interpretation of the Results of Agricultural Experiments, November, 1911 Price 4*d* , post free.
No. 8. Report on the Isle of Wight Bee Disease, May, 1912. Price 1*s*., post free.
No. 9. Notes on Kerry Woods, illustrating Methods of Collecting and Utilising Information for a Forest Survey, August, 1912 Free on application.
No 10 Further Report on the Isle of Wight Bee Disease, July, 1913. Price 4*d* , post free
No. 11 The Correlation between the Percentage of Milk Fat and the Quantity of Milk Produced by Ayrshire Cows, August, 1913. Price 4*d* , post free.
No. 12. The Possibility of Reviving the Flax Industry in Great Britain, January, 1914 Price 4*d* , post free

Report of the Horticulture Branch.

The Annual Report of the Horticulture Branch of the Board for 1912-13 was issued in February [Cd 7232, price 2*s* 2*d*] This Report gives an account of the proceedings of the Board under the Destructive Insects and Pests Acts, 1877 and 1907, and the Board of Agriculture Act, 1889 This, the first Report of the Horticulture Branch, replaces the Report hitherto issued as Part II of the Annual Report of the Intelligence Division

The scope of the work of the new Horticulture Branch is explained in an introduction, while the body of the Report describes the action taken in 1912–13 with regard to American Gooseberry Mildew, Wart Disease of Potatoes, Large Larch Sawfly, Vine Louse, Mediterranean Fruit Fly, and Tomato and Cucumber Canker. There are coloured maps at the end of the Report showing the amount of American Gooseberry Mildew in various districts, the distribution of Wart Disease of Potatoes in England and Wales, and the distribution of the Large Larch Sawfly in the Lake District

Agricultural Research.

The Board of Agriculture and Fisheries are prepared to receive, not later than April 15th next, applications for grants in aid of scientific investigations bearing on agriculture. Forms of application with particulars of the conditions on which grants are made can be obtained from The Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S W.

MISCELLANEOUS NOTES.

Importation Regulations.

Importation of Potatoes into South Africa.—The Board have been asked to give publicity to a circular letter recently issued at the instance of the Union Department of Agriculture with reference to potatoes imported into South Africa.

The circular states that considerable inconvenience and delay are often caused by the introduction into South Africa of potatoes which are not accompanied by the necessary certificates. Further, it appears that when the certificates are sent, they are not always sufficiently comprehensive to comply with the regulations, a common omission being the important declaration respecting the place of origin of the potatoes. In these circumstances

it may be useful to outline the regulations so far as they apply to certificates. Potatoes imported into the Union of South Africa must be accompanied by:—

(*a*) A statement on oath from the consignor, declaring the country and place or places in which the potatoes were grown, and giving data clearly establishing the identity of the consignment.

(*b*) A certificate from the Board of Agriculture and Fisheries to the effect that, at a date not more than thirty days before the despatch of the consignment, Wart Disease has not been known to exist within five miles of the place or places in which the potatoes are declared to have been grown.

This certificate is not necessary, however, if the consignee produces a certificate of the Board of Agriculture and Fisheries, dated within nine months of the arrival of the potatoes concerned, to the effect that Wart Disease has not been known to exist in the country comprising the place or places in which the potatoes are declared to have been grown. An attested copy of this certificate may, however, be required.

The regulations respecting the packing, inspection and fumigation of potatoes sent to South Africa will be found in this *Journal* for August, 1913, p. 448.

Importation of Live Plants by Post into Russia.—The official *Messenger of Finance* of St. Petersburg of January 25th publishes a Customs Circular, No. 47508 of 1913, which states that parcels of live plants entering Russia by post must be accompanied by two certificates:—

(1) A certificate by a competent local authority to the effect that the plants proceed from a plot of land not less than 22 yards from any vine, or separated therefrom by other adequate obstacle against the spread of its roots, that there is no depot of vines on the plot, and that in the event of any infected vines having previously been on the plot the investigations made in the three years following the extraction of the vine roots and the sterilisation of the soil prove the complete destruction of the phylloxera and of the roots

(2) A declaration by the consignor that the entire contents of the parcel come from his own establishment, and that the parcel contains no vines nor any plants with clods of earth attached, the destination of the parcel and the address of the receiver must also be indicated

Importation of Potatoes into Argentina.—H.M. Minister at Buenos Aires states that a law recently passed permits the importation of potatoes for consumption into Argentina free of duty Hitherto only potatoes for seed have been admitted duty free.

Notes on Agriculture Abroad.

The Work of the Canadian Experimental Farms.—The Canadian Department of Agriculture have recently published a review of the work of the Dominion experimental farms since the time of their inauguration In the early eighties the conditions of agriculture in Canada had reached a comparatively low standard, and for this reason it was felt that steps must be taken to improve the practice and theory of the industry. An Act was therefore passed in 1886 authorising the establishment of a central experimental farm and four branch farms, and in October of the same year a Director was appointed to take charge of the work. By 1888 the land for the several farms had been secured, the necessary officers were appointed, most of the buildings had been erected, and the farms were put into practical operation. The farms were situated in districts

representative of the largest farming areas in the provinces they were to serve; the central farm at Ottawa; and branch farms at Nappan, Nova Scotia; Brandon, Manitoba; Indian Head, North-west Territories; and Agassiz, British Columbia. During the past four years eleven new farms or stations have been added, so that every province has now been reached, while sub-stations have been established to serve outlying districts. The experimental farms publish an annual report, and bulletins are issued dealing with special subjects.

That farmers appreciate the value of the information and advice obtained by them from the Departments' farms when they are confronted with problems which they are personally unable to solve is shown by the fact that whereas in 1889 the total number of letters received at the experimental farms was about 8,000, in 1911-12 the number had risen to about 124,000, and while in 1889 comparatively few reports and bulletins were issued, in 1911-12 no fewer than 200,000 copies were distributed.

The review gives the following information as to the activities of the farms in the various branches of agriculture:—

Seeds, Crops and Fertilisers.—Attention has been devoted to selection of wheat with the view of breeding the most suitable species as regards productiveness, earliness, and milling and baking qualities Red Fife, being the standard high-grade wheat in Canada, has been largely used for crossing, and a variety thus obtained named Marquis has met with great success, since, in addition to possessing the well-known qualities of Red Fife, it ripens earlier. Samples of cereals and potatoes are distributed to farmers, and during the first ten years' working of the farms about 10,000 samples amounting to some 60 tons were sent out annually. Since then the yearly average has been about 38,000 samples, while in 1910 the number distributed reached 50,000

The farms have taken a leading part in encouraging the use of silage for stock, and have introduced systems of crop rotation

Experiments have been conducted to ascertain the relative value of various fertilisers, and among other important conclusions reached it has been proved that farmyard manure can be more economically used if applied in a fresh or unrotted condition, because while fresh manure is equal ton for ton in crop-producing power to rotted manure, the loss in weight due to rotting may amount to as much as 60 per cent

Experiments have also been conducted in the sowing of seed by hand and by drilling, and tests have been made of various drainage systems

Live Stock—At each of the experimental farms are maintained herds of beef and milking cattle and of swine The central farm keeps Shorthorn, Ayrshire, Guernsey, Canadian, Jersey and Holstein cattle, and Yorkshire, Berkshire and Tamworth pigs. Experimental work with live stock has chiefly been in the feeding of cattle and swine, and in dairy work. At the central farm the dairy herd numbers upwards of fifty head, and is maintained at a high standard. Records are made of the food given to each animal, and of milk yield, and by eliminating the poor or unprofitable cows the production per head has been greatly increased. The pigs are similarly dealt with, and those fed at the central farm have for many years yielded a substantial profit. Experiments in the feeding of working horses have also been made, and definite conclusions have been reached as to the cheapest and most nutritious rations. The ventilation of stables and sheds has been thoroughly investigated, and after careful trials the "Rutherford" system has been adopted at the farms as being the most effective.

Horticulture.—Up to the time the farms were established little experimental work in fruit growing had been undertaken in Canada except by individuals The Horticultural Division was established in 1887 at the central farm with an experimental area of 40 acres. In 1898, woodland belts covering about 21 acres were added, and the arboretum and botanic garden, extending over 65 acres, were included in the Division, making the total area about 126 acres. In 1911, the arboretum and botanic garden were placed under the control of the Botanical Division. During the first 8 or 10 years more than 200 of the hardiest sorts of cultivated apple trees from northern Europe and other northern countries were tested. A large number of crosses were obtained with the view of producing apples sufficiently hardy to thrive in the colder parts of the country The investigations have been made chiefly at the central farm at Ottawa, which, on account of its situation, is admirably adapted to the process of eliminating the less hardy sorts A record is kept of the quantity of fruit each tree bears at the central farm Much experimental work has also been done with plums, pears, cherries, grapes, etc , in order to discover the varieties and treatment suitable for climatic and other conditions in each district.

Forestry—At each of the farms a large number of species and varieties of trees have been tested, and the information thus obtained has been published in bulletin form and placed at the disposal of settlers and others

Chemistry—Since 1889 the central farm has possessed a well-equipped chemical laboratory in which the analytical work for all the farms has been done Through this work the Chemist has been kept in close touch with agricultural problems and has thus been able to render direct assistance when scientific aid was necessary Inquiries are dealt with as to soils, fertilisers, feeding stuffs, dairy products and other matters of importance Investigations have been conducted in relation to the factors governing soil fertility

Poultry—Tests have been made with utility breeds of poultry with regard to early maturity, egg production, development of laying strains, vitality of stock, housing, feeding, natural and artificial incubation, and many other points, and by discarding poor layers it has been shown to be practicable to build up prolific-laying strains Repeated tests in hatching with incubators heated by electricity have proved this system to give excellent results The information gained by these experiments is published in English and French, and is sent free of charge to all who desire it It is stated that the work of the Poultry Division has had a marked influence on the poultry industry of the country

Botany and Entomology—The Division of Botany deals with weeds, poisonous and economic plants, and the diseases which attack vegetation Helpful information is sent to correspondents who send specimens of special weeds. The Division of Entomology is chiefly concerned in the administration of the Destructive Insect and Pest Act, passed in 1910, and in the control thereunder of the fumigation stations which have been established to prevent the introduction of the San José Scale and other pests. This Division also maintains an apiary for experimental purposes

Control of Seeds in Queensland.—An Act recently passed in Queensland (the Pure Seeds Act of 1913), regulates the sale of seeds for planting or sowing Briefly, the Act makes three important provisions and imposes penalties in cases of non-compliance —

(1) The amount of foreign ingredients in seeds so sold is to be prescribed.

(2) An invoice must be given by the vendor to the purchaser where the purchase is above one shilling in value and must specify the kind or kinds of seeds referred to, and that the seeds are for planting or sowing. The invoice is to constitute a warranty by the vendor that such seeds are for planting or sowing, that they are of the kind or kinds so specified, and that they contain no greater amount of foreign ingredients than is prescribed.

(3) In the case of parcels of seeds, the year in which they were grown must be clearly marked on the outside of the parcel.

The Act also provides for the appointment of experts and other officers with power to enter premises on which seeds are sold, stored, or prepared, for the purpose of inspection and confiscation of unfit seeds. Samples of seeds are also to be obtained by purchase by these officers for the purpose of examination.

The Weather in England during February.

District	Temperature		Rainfall			Bright Sunshine	
	Daily Mean	Diff. from Average	Amount	Diff. from Average	Number of Days with Rain.	Daily Mean	Diff. from Average
Week ending Feb. 7th:	°F.	°F.	Inches	Inches		Hours	Hours
England, N.E.	46·8	+7·6	0·14	—0·22	2	2·4	+0·3
England, E. ..	45·3	+6·4	0·14	—0·24	2	3·9	+1·5
Midland Counties	46·5	+7·4	0·21	—0·30	2	2·3	+0·4
England, S.E... ...	45·4	+5·0	0·55	+0·02	2	5·3	+3·3
England, N.W.	47·9	+7·9	0·26	—0·44	2	1·3	—0·3
England, S.W.	47·6	+6·0	0·65	—0·17	3	2·5	+0·5
English Channel .	47·4	+3·0	0·31	—0·35	2	4·3	+1·8
Week ending Feb. 14th							
England, N.E.	45·3	+6·6	0·40	+0·02	6	2·7	+0·3
England, E.	46·5	+8·1	0·58	+0·21	5	2·7	+0·1
Midland Counties	45·4	+6·8	0·76	+0·29	6	2·1	0·0
England, S.E.. .	46·8	+6·8	1·31	+0·79	6	1·8	—0·4
England, N.W. ...	45·2	+5·6	1·27	+0.65	6	2·3	+0·3
England, S.W. ..	46·2	+5·0	1·91	+1·15	6	1·4	—0·9
English Channel ...	47·8	+3·8	1·63	+0·99	6	1·3	—1·5
Week ending Feb. 21st:							
England, N.E.	41·8	+3·4	0·45	+0·10	4	2·8	+0·2
England, E. ..	42·2	+4·0	0·88	+0·52	5	2·0	—0·7
Midland Counties	41·6	+3·2	0·84	+0·41	5	1·7	—0·7
England, S.E. ...	43·1	+3·4	1·57	+1·10	6	1·5	—1·2
England, N.W.	42·2	+2·9	1·10	+0·55	6	2·2	—0·2
England, S.W. ...	43·0	+2·0	1·52	+0·80	6	2·1	—0·6
English Channel ...	45·5	+1·6	1·72	+1·08	7	2·0	—1·3
Week ending Feb. 28th							
England, N.E. ..	42·3	+3·3	0·17	—0·16	3	2·6	—0·1
England, E.	41·7	+3·3	0·08	—0·25	2	4·2	+1·3
Midland Counties ..	41·5	+3·0	0·16	—0·24	3	2·5	0·0
England, S.E.... ...	42·0	+2·2	0·18	—0·25	3	4·5	+1·5
England, N.W. ...	42·7	+3·3	0·60	+0·08	4	3·1	+0·2
England, S.W. ...	42·9	+1·9	0·50	—0·18	5	3·0	0·0
English Channel ...	45·4	+1·4	0·23	—0·37	4	4·9	+1·4

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural and Commercial Statistics* for February, 1914, gives a figure which may be taken approximately to represent the world's production of wheat in 1913–14. The countries included are Germany, Austria, Hungary, Belgium, Bulgaria, Denmark, Spain, France, Great Britain and Ireland, Italy, Luxemburg, Netherlands, Rumania, Russia in Europe (63 governments), Switzerland, Canada, United States, India, Japan, Russia in Asia (10 governments), Algeria, Tunis, Argentina, and Australia. The total production is placed at 488,731,000 qr., as compared with 455,379,000 qr. in 1912–13, the increase being equal to 7.3 per cent., while the area under production shows an increase of 1.7 per cent.

Hungary.—The final figures of the harvest of 1913 give the production of wheat as 21,025,000 qr., which is less than in 1912 by 8.9 per cent. Rye and maslin amounted to 6,532,000 qr., a decrease of 1.5 per cent.; barley to 9,931,000 qr., an increase of 14.8 per cent.; oats to 10,866,000 qr., an increase of 32.0 per cent.; maize to 24,613,000 qr., an increase of 5.1 per cent.; and sugar beet to 4,787,000 tons, an increase of 0.5 per cent.

Sweden.—The production of wheat in 1913 is estimated to have amounted to 1,166,000 qr., which shows an increase of 19.7 per cent. as compared with 1912. Rye amounted to 2,597,000 qr., a decrease of 3.5 per cent.; barley to 2,029,000 qr., an increase of 19.5 per cent.; oats to 10,235,000 qr., an increase of 13.7 per cent., and sugar beet to 832,000 tons, an increase of 1.0 per cent.

Russia in Asia.—The final figures of the production of winter cereals in the 24 governments and provinces of Russia in Asia place wheat at 4,532,000 qr., or an increase of 4.5 per cent. as compared with 1912; rye at 2,802,000 qr., a decrease of 10.4 per cent.; and barley at 1,508,000 qr., an increase of 16.6 per cent.

Sowing of Winter Cereals.—The areas sown with winter cereals, compared with the areas sown during the corresponding period of last year, expressed as percentages, are given as follows:—*Wheat*.—Belgium, 103; Denmark, 100; Spain, 109; France, 101, England and Wales, 109; Scotland, 105; Italy, Luxemburg and Portugal, 100, Rumania, 135, Switzerland, 101, Canada, 93, United States, 109, India, 87, Japan, 103; and Tunis, 90. *Rye*.—Belgium, 99; Denmark and Spain, 100, France, 103, Italy, Luxemburg and Portugal, 100, Rumania, 102, Switzerland, 96, and United States, 99. *Barley*.—Belgium, 99; Spain, 98, France, 91, Italy, Luxemburg and Portugal, 100; Rumania, 119; Switzerland, 121; Japan, 92; and Tunis, 90. *Oats*.—Spain, 105, France, 101, Italy and Portugal, 100; and Tunis, 90.

France.—The *Journal Officiel* of February 13th gives the following official estimates of the production of table fruits in 1913 (in cwt.):—Apples (dessert), 1,790,274, pears (dessert), 482,381; plums (other than those to be converted into prunes), 274,500, cherries, 274,010; chestnuts, 5,426,321; walnuts, 618,464; almonds, 16,597; strawberries, 235,350; raspberries, 8,161; blackcurrants, 46,813; and gooseberries, 18,909.

The production of cider and perry in 1913 is estimated at 574,853,000 gall., compared with 349,351,000 gall. in 1912 and 481,766,000 gall. in 1911 (*Ibid.* January 18th.)

The *Journal Officiel* gives the following estimates of the condition of the crops on March 1st:—Winter wheat, 71, compared with 73 last

month and 72 on March 1st, 1913 ; winter oats, 66, compared with 71 and 73 ; and rye, 73, compared with 71 and 73. (*Dornbusch*, March 9th.)

Italy.—The *Notizie Periodiche di Statistica Agraria* of December gives the final official estimate of the production of last year's maize crop as 12,642,000 qr., compared with 11,508,000 qr. in 1912.

United States.—The Department of Agriculture estimates the amount of last year's cereals still in farmers' hands on March 1st as follows (stocks on the same date in 1913 in brackets) :—Wheat, 151,809,000 bushels or 19.9 per cent. (156,483,000 bushels or 21.4 per cent) ; maize, 868,692,000 bushels or 35 4 per cent (1,289,655,000 bushels or 41.3 per cent.) ; oats, 419,476,000 bushels or 37 4 per cent. (604,216,900 bushels or 42.6 per cent) ; and barley, 44,126,000 bushels or 24.8 per cent. (62,283,000 bushels or 27 8 per cent). (*Dornbusch*, March 7th)

Argentina.—H.M. Minister at Buenos Aires reports (February 5th) that the area under maize this season is officially estimated at 10,255,000 acres, or 845,000 acres more than was sown last season. It is considered that the early sown maize cannot now be damaged by unfavourable weather, and with a few more rains in some districts the success of the entire crop will be assured. It is probable that the estimated yield of 41,000,000 qr will be realised, and in this case the surplus for export will amount to between 27,500,000 and 32,000,000 qr., or some 9,000,000 qr more than in 1913.

The *Review of the River Plate* of February 6th states that threshing results in the provinces of Cordoba and Santa Fé have continued to be most unsatisfactory , the quality is very light and in many parts the yield exceedingly poor This has reduced the estimated wheat export surplus to about 8,000,000 qr

Western Australia.—A forecast published in the issue for last November of the *Monthly Statistical Abstract* of this colony gives the probable production of wheat in 1913–14, from an area of 1,068,547 acres, at 13,905,221 bushels, compared with 9,168,594 bushels from 793,096 acres in 1912–13, and the production of oats at 2,327,624 bushels from 140,416 acres; compared with 2,105,812 bushels from 127,645 acres in 1912-13.

New South Wales.—An official mid-harvest statement estimates the production of wheat grain in 1913–14 at 41,800,430 bushels, compared with 32,487,336 bushels in 1912–13. The areas were, respectively, 3,136,671 and 2,231,514 acres. (N S W *Monthly Statistical Bulletin*, November, 1913)

Tasmania.—The Acting Government Statistician, in a forecast issued on January 7th, gives the following estimates of the produce of the current season's (1913–14) crops (in bushels, with 1912–13 figures in brackets) :—Wheat, 421,380 (630,315) , oats, 2,591,029 (2,257,258) ; English barley, 261,109 (235,596) ; Cape barley, 29,393 (30,312) ; peas, 633,938 (453,682) ; hay, 115,124 tons (183,079 tons) ; and potatoes, 106,596 tons (72,565 tons).

Live Stock in Germany.—The provisional results of the census of live stock taken on December 2nd, 1913, give the number of cattle as 20,944,258, against 20,182,021 on the same date in 1912, an increase of 3.8 per cent ; of sheep as 5,504,195, against 5,803,445, a decrease of 5.2 per cent. ; of pigs as 25,591,794, against 21,923,707, an increase of 16.7 per cent. ; and of goats as 3,535,697 compared with 3,410,396, an increase of 3.7 per cent. (*Bulletin of Agricultural and Commercial Statistics*, February, 1914.)

Agricultural Labour in England and Wales during February.

The supply of agricultural labour in England and Wales during February was, according to statements in the Board's Monthly Agricultural Report (March 1st., 1914), on the whole sufficient for present requirements; but in various directions some apprehension was expressed that scarcity may be felt when the approaching busy season sets in.

The counties in which the supply was as a rule sufficient were Northumberland, Durham, Lancashire, Yorkshire, Derby, Nottingham, Leicester, Rutland, Lincoln, Norfolk, Suffolk, Cambridge, Huntingdon, Bedford, Northampton, Warwick, Buckingham, Oxford, Berkshire, Worcester, Hereford, Gloucester, Dorset, Wiltshire, Hampshire, Surrey Kent, Sussex, Essex. Hertford and Middlesex, and throughout Wales generally

A scarcity, particularly of skilled men, was occasionally reported from parts of Lancashire, Shropshire, Stafford, south Leicester, Bedford, Northampton, Warwick, Buckingham, Oxfordshire, Berkshire, Worcester, Hereford, Gloucester, Cornwall, Devon, Somerset, north-east Kent and south-west Sussex; and casual labour was scarce in north-east Cheshire There was a slight shortage of permanent men in north Northumberland

In south-west Cumberland and north Westmorland, capable farm servants were scarce everywhere, especially good men for draining work, who can at present earn, by piecework, from 5*s*. to 9*s* a day. In north-east Leicester good permanent men for dairying were scarce In east Hereford there was a good demand for carmen and carters at advanced wages

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Agricultural Conditions in England and Wales on March 1st.

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales during February, state that the autumn sown crops are in a very satisfactory condition Wheat is almost everywhere a full plant, healthy and vigorous, with perhaps a tendency in some counties to be slightly too forward There was a good deal of rain during the month, which has done no harm, except in the south-east—mainly in Sussex—whence the reports are unfavourable Winter oats and beans are also very generally satisfactory

In most districts a little spring corn has been got in, but hardly any was showing above ground by the 1st March Preparation of the land was, however, generally well forward, and it is expected that the corn will go into a good seed-bed There are, however, from various districts reports that there had been too much rain during February—particularly in Sussex and adjoining counties, and in Wales—where work had been much impeded About a quarter of last year's potato crop is considered to be now remaining in the growers' hands

Lambing is generally in full swing in the more southern districts, with results that may generally be described as quite up to the average, and in many cases satisfactory. Twins are in some instances reported to be scarcer than usual, but ewes and lambs are generally strong and healthy, and the mortality would seem to be less than the average. In the more northern districts, where lambing is only just commencing, the ewes are in good condition, and prospects are quite satisfactory

Other stock are generally thriving and in good condition, the mild open weather having generally been suitable to them.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on March 1st, 1914, certain diseases of animals existed in the countries specified:—

Austria (on February 25th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 457 Höfe infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period February 1st—15th).

Anthrax, Blackleg, Foot-and-Mouth Disease (27 outbreaks in 21 communes), Rabies.

Bulgaria (for the period January 29th—February 6th)

Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Sheep-scab

Denmark (month of January).

Anthrax, Swine Erysipelas, Swine Fever.

France (for the period February 15th—21st).

Anthrax, Blackleg, Foot-and-Mouth Disease (97 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period February 1st—15th).

Foot-and-Mouth Disease (183 infected places in 50 parishes), Glanders and Farcy, Swine Fever.

Holland (month of January).

Anthrax, Foot-and-Mouth Disease (1 outbreak), Foot-rot, Glanders, Swine Erysipelas

Hungary (on February 7th).

Anthrax, Dourine, Foot-and-Mouth Disease (total of 1,026 "cours" infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever

Italy (for the period February 9th—15th)

Anthrax, Blackleg, Foot-and-Mouth Disease (604 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever

Montenegro (for the period January 1st—15th)

Glanders and Farcy, Sheep-pox

Norway (month of January).

Anthrax, Blackleg, Swine Fever.

Rumania (for the period February 5th—13th).

Anthrax, Dourine, Foot-and-Mouth Disease (12,700 animals), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever

Russia (month of October).

Anthrax, Foot-and-Mouth Disease (83,025 animals in 1,047 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period January 31st—February 7th).

Rabies, Sheep-pox, Sheep-scab.

Spain (month of November).

Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (6 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of January).

Anthrax, Blackleg, Swine Erysipelas.

Switzerland (for the period February 16th—22nd).
Anthrax, Blackleg, Foot-and-Mouth Disease (108 "étables" entailing 1,409 animals, of which 25 "étables" were declared infected during the period), Swine Fever.

THE CORN MARKETS IN FEBRUARY.

C. KAINS-JACKSON.

British Wheat—The sales at Mark Lane during February were fully up to the average and decidedly above January business There was no fall in price, and marked improvement may safely be affirmed on the four weeks' trade The country markets have been fairly well supplied, but demand has often been small, and in the North some low averages have been recorded The last four days of the month, however, witnessed a distinct rally, and on the 28th, which was a Saturday, a great day for local markets, 6*d* advance was fairly general. Poultry corn sold well all through the month and the supply was often below the local inquiry. The run on inferior English is partly due to the failure of Canada to ship any wheat of really low grade owing to an unusually high quality harvest in the Dominion, where the small percentage of poultry wheat is all required for home needs. Prices at the close of the month were about 37*s* per 504 lb. for the very finest English white, and 36*s* for red, while 31*s*. to 32*s*. 6*d*. per 480 lb. was the general range of value for ordinary lots at ordinary markets

Colonial and Indian Wheat—Some exchanges advanced as much as 1*s* 6*d* on the month for the two top grades of Canadian, and the rise was 1*s* at the least active exchanges The cause of the advance was the need of strong wheat for mixing, and the failure of Russian exports to get through to our ports The Continent can always stop these supplies at level prices, for the lower freights are a standing inducement to land corn at nearer ports The Indian wheat supply has been much below the average and there were only 50,000 qr of that sort on passage against 300,000 qr. a year ago Australia has shipped her new crop freely, and is the chief source of prospective supply for May and June

Foreign Wheat—The price of Russian has been moderate, and 6*d* advance was paid before the close of the month The supply has been below demand and there is promise of a further rise On the other hand Argentine wheat is an uncertain market, for while the exportable surplus is put at two million quarters less than last year, the date at which the surplus will be sent forward depends largely on local matters, such as railway freights, tonnage of shipping available at a low price, or demand for gold as compared with the spot currency, such matters making it difficult to forecast the price of Argentine wheat on the British markets of the spring. Late in the month several cargoes on passage were sold at 35*s*. per qr, and on the 28th 35*s*. 6*d*. was paid. New York closed with a wheat quotation of 36*s* 5*d*. for winter sorts, and 36s. 8*d* for spring. As was observed last month the spring sort is usually at least a shilling dearer than the winter. Present prices in London and Liverpool would need to be advanced 1*s*. to 1*s*. 6*d*. before the cost of freight and insurance was covered and a profit shown.

Wheat Supplies and Shipments.—The liberal shipments of wheat from Australia formed the shipping event of the month, and the exports for the first nine weeks of 1914 were returned at 2,495,000 qr. The four preceding years saw exports in the like period of: 1913, 1,202,000 qr.; 1912, 1,288,000 qr.; 1911, 1,706,000 qr.; and 1910, 1,860,000 qr.

While 1914 figures constitute an easy record, the decline in Argentine exports for the same nine weeks, from 2,734,000 qr. in 1913 to 1,189,000 qr this year, bears out the forecasts of experts who, at the end of 1913, were writing of Argentine and Australian exports for 1914 as likely to be the same as in 1913—the Australian increase balancing the Argentine reduction. Thus far there is an increase of 1,293,000 qr. in the one case and a decrease of 1,543,000 qr. in the other. The shipments of February from Canada and the United States fell rather sharply from the January standard, and were only 1,280,000 qr. Russia shipped 1,400,000 qr, but only 50,000 qr to the United Kingdom. Europe S E shipped 729,000 qr, this too being absorbed almost entirely by Continental ports The cargoes reaching us from Rumania have shown higher quality than usual Indian shipments were only 29,000 qr the growing wheat is now ripening favourably to its April harvest, but the returns of damage earlier in the season, combined with a somewhat reduced acreage, compel buyers to recognise that the choice of Indian wheat on our markets in 1914 is likely to be limited Total supplies on passage show an advance 1st January, 1,470,000 qr ; 1st February, 2,610,000 qr , 1st March, 3,330,000 qr. Stocks in the chief ports show a decline : 1st January, 1,946,000 qr , 1st February, 1,800,000 qr., 1st March, 1,565,000 qr. The imports of February were below the average, and the markets would probably have advanced earlier than they did, but for the remarkably mild weather being adverse to grain going at all briskly into consumption.

Flour—The demand from the 1st to the 23rd was poor, but from the 23rd to the end of the month buying was brisk. The price of best London flour has increased by only 6*d*, 31*s*. 6*d* being quoted against 31*s* in January, but Town Whites were up to 30*s*, and Households to 27*s*, these prices showing 1*s* advance Hungarian was very scarce on spot, and closed at 40*s* per sack Country flour rose 6*d* on the month, Roller Whites making 24*s* per 280 lb, cash North American shipments dropped to 342,000 sacks, and only 168,000 sacks were on passage on the 28th Imports of flour during February were remarkably small.

Barley—The demand for English has been considerable, and large quantities—for the time of year—have been placed both at Mark Lane and in the country Total sales at the statute markets for the first half of the cereal year exceeded 3,000,000 qr, which is nearly three quarters of a million increase on the previous season This, combined with the mild weather, prevented the much diminished receipts from abroad from imparting to the exchanges that advancing tendency which otherwise must have been induced. The end of the month, however, saw some rise in the price of feeding kinds. Russian closed at 21*s*. 3*d*. to 21*s*. 6*d*. Malting barley did not improve in price during February, but in the last week there was more buying of seed corn. Shipments were 828,000 qr from Russia, 225,000 qr. from Europe S.E., 60,000 qr from North America, and 15,000 qr. from South America. India did not ship The quantity on passage on the 28th was 330,000 qr, including 40,000 qr. Russian feeding, 215,000 qr. Californian brewing, 15,000 qr. Anatolian brewing, and 50,000 qr. "all other countries," including American and Indian. A year ago 570,000 qr. were on passage.

Oats.—Sales of British oats in London were fair. Towards the end of the month the opening of the series of London Horse Shows helped

inquiry for heavy oats, which made 21*s*. to 25*s*. per 336 lb. The price at the country markets showed a slight improvement, but was still decidedly low as compared with 1913 and 1912. South America rather disappointed the buyer by shipping only 468,000 qr, against 936,000 qr. in January Prices advanced to 15*s*. 6*d*. and 15*s*. 9*d* before the end of the month Russia's shipment of 279,000 qr. for February was also below expectation. On the 27th, Mark Lane was fairly active, with 19*s* per 320 lb paid for Vologda, 16*s*. per 304 lb. for White Libau, and 15*s*. 6*d* for Black Sea Some oats from the Canadian North-West were to hand at 18*s*. 6*d* per 320 lb, but the weight was made-up On the 28th there were 420,000 qr. on passage.

Maize.—This staple has tenaciously maintained a level price of five shillings per cental, and the latest tendency is towards a higher price. The Mark Lane prices were 25*s* per 480 lb for Argentine Yellow off stands, 23*s* 6*d* for Russian Old Crop, 24*s* for Russian New Crop, 26*s*. for American flat, and 27*s* for Burmese Of the last two kinds there were scarcely any supplies The Argentine new crop was offered for June shipment at 22*s* 6*d*, and for July at 22*s*, and hence the British buyer is already able to make himself fairly secure for the last four months of 1914 Some high estimates of the Argentine exportable surplus were current, even 26,000,000 qr being mentioned. Meanwhile, stocks of old maize have seldom been so low in the United Kingdom, the United States and Russia Shipments for February were 53,000 qr from North America, 598,000 qr from South America, 109,000 qr from Russia, and 285,000 qr from Europe S E There were only 310,000 qr. on passage on the 28th

Oilseeds—Cheap linseed, linseed oil and linseed cake continued to be available in our markets, but the buying was so good that before the month closed 49*s* 6*d* was made for Calcutta linseed, 44*s*. for Argentine, 50*s* for Russian, and 52*s* for Dutch The imports of linseed into London, 1st January to 28th February, were about 120,000 qr, and into Hull about 80,000 qr The London trade was a very large one. Liverpool is making great efforts to develop its trade in linseed The supply on passage to the United Kingdom on the 28th was 333,000 qr

Various.—Beet sugar remains very cheap A high temperature has been against sales of beans and peas, but prices have been maintained at 35*s*. for English spring beans, 38*s* for maple peas, and 33*s* for dun peas Farm seeds have been in good demand, especially English red clover, which is good, cheap, and abundant, 55*s*. per cwt being about the price for good quality Oatmeal has fallen 5*s* per ton, and malt has declined about 1*s*. per quarter on the month

THE LIVE AND DEAD MEAT TRADE IN FEBRUARY.

A. T. MATTHEWS

Fat Cattle—For the first three weeks of February the cattle trade, as a whole, was steady as regards average prices, though there were many fluctuations in the individual markets Supplies for the first eight weeks were as much as 10 per cent below the average of the last three years, but prices have been no higher than in the corresponding period last year, which, taken by itself, is rather surprising. Towards

the close of the month, however, there was a distinct upward movement, and in the last week there was a fairly general advance of 2*d.* per 14-lb. stone. At Leeds there was an improvement of 7*d.*, and at Norwich one of 5*d.*, for first quality Shorthorns. Altogether 11 markets out of 20 were quoted higher, and only three were lower for this class of cattle. The highest point touched for Shorthorns during the month was 9*s.* 9*d.* at Ipswich, and this was exactly ½*d.* per lb. above the general average of the country for that week

The average prices for the various breeds in the English and Welsh markets during February were :—Shorthorns, 9*s* and 8*s.* 4*d.* per stone for first and second quality, against 8*s.* 10*d.* and 8*s.* 2*d.* in January ; Herefords, 9*s.* and 8*s.* 6*d.*, against 9*s.* and 8*s.* 5*d.* ; Devons, 8*s* 11*d* and 8*s* 3*d.*, against 9*s.* and 8*s* 3*d.* Welsh Runts were only quoted at Salford, where they seem to have realised relatively high prices.

In the six English markets officially quoted by live weight only, the average price of prime Shorthorns advanced from 40*s* 11*d.* to 42*s.* 4*d.* per cwt

Veal Calves.—There was a remarkably steady trade at very good prices for calves for slaughter, and average prices were 9½*d.* and 8½*d.* per lb. for first and second quality, which represents an advance of ¼*d.* over January prices.

Fat Sheep—There was a tendency to slackness in some markets at the beginning of the month, but a speedy recovery took place, and average values were quite as high as in January. With the decided reduction in total supplies any falling-off in values would have been a matter for surprise. The supplies since the beginning of the year have been 379,638, against 405,255, the average of the same period in the last three years This means a falling off of 3,200 per week ; in the last week the deficiency was 6,000. It is good news that the lambing season is nearly everywhere a favourable one, for it is quite clear that the country badly needs more sheep Prices for the month averaged as follows (January figures in brackets) :—Downs, 10*d*, 9*d* and 7½*d* per lb (same prices) for the three qualities ; Long-wools, 9¾*d*. 8½*d* and 7*d.* (9¾*d*, 8¾*d* and 7*d*) ; prime Cheviots, 10½*d.* (10¼*d.*) ; and prime Cross-breds, 10*d* (10*d.*).

Fat Lambs—These are still only quoted in about six markets, where they have averaged 1*s* 1*d.* and 1*s* per lb. for first and second quality respectively The best prices were made, as usual, in the northern markets, such as Leeds, Wakefield and Salford.

Fat Pigs.—The downward tendency in the value of bacon pigs which threatened the trade in January, was short-lived, and prices recovered in February. Prime small weights averaged 8*s* 4*d.* per 14 lb. stone, and heavier pigs 7*s.* 10*d.* At Nottingham and Salford in the last week, quotations touched 9*s.*, while at Ashford (Kent) the highest was 7*s.* 8*d.*

Carcass Beef—British—The supplies of Scotch beef at the Central Market have varied from 40 to 120 tons per day, and the trade has shown little animation. Prices remained stationary for the first three weeks at 4*s.* 8*d.* and 4*s.* 6*d.* per 8 lb. for short, and 4*s.* 6*d.* and 4*s.* 4*d.* for long or whole sides. In the last week with a smaller quantity of fresh-killed on offer, an advance of 2*d.* per stone was established. English sides averaged 4*s.* 5*d.* and 4*s.* 2*d.*, making 4*s.* 6*d.* in the third week, equalling the quotation for Scotch—this being unusual.

Chilled Beef.—Supplies of Argentine chilled have been well maintained, and prices have remained very similar to those of January.

For the first three weeks hind quarters realised 3*s*. 6*d*. and 3*s*. 4*d*., and fores were quoted each week at 2*s*. 10*d*. and 2*s*. 9*d*. per stone. In the last week there was an advance of 2*d* for hind quarters.

Frozen Beef.—The trade for Australian and Argentine frozen beef lacked any features worth noting, prices maintaining a dead level at 3*s*. and 2*s*. 10*d*. for hind quarters, and 2*s*. 8*d*. and 2*s*. 7*d*. for fores

Carcass Mutton—Fresh Killed.—Scotch mutton in the Central Market was quoted uniformly at 5*s*. 6*d*. and 5*s*. 2*d*. till the last week, when there was an advance of 2*d* per stone. Very small tegs weighing about 32 lb., have realised 5*s*. 8*d* and occasionally 6*s*. per stone, and six-stone wethers 5*s* 4*d* English averaged 5*s*. 1*d* and 4*s*. 9*d*

Frozen Mutton.—Argentine mutton realised 3*s*. and 2*s* 8*d* per stone for the first week, but afterwards declined 1*d* Australian was practically of the same value.

Lamb — British —Home-killed lamb was in limited request, but as the month progressed, prices somewhat improved. Starting at 7*s*. per stone there was an advance of 8*d* by the last week, the average being 7*s*. 3*d*. and 6*s*. 7*d*. for the two qualities.

Frozen Lamb —New Zealand lamb of the new season becoming more plentiful, prices have been much lower than those given for the first arrivals. The averages were 4*s*. 5*d* and 4*s* 2d per 8 lb., while Australian and Argentine realised 4*s*. and 3*s* 8*d*.

Veal —Best English veal has realized good prices, 5*s* 8*d*. per stone being the top quotation Lower grades have sold at 4*s*. 8*d* , and very small carcasses at 3*s* 4*d* per stone.

Pork —Prices of English porkers have varied to the extent of 4*d*. per stone, according to the supply, but on the whole, there was a very good market, though prime quality has not exceeded 5*s*. The averages for the month were 4*s*. 10*d*. and 4*s*. 5*d*. for the two qualities.

THE PROVISION TRADE IN FEBRUARY.

HEDLEY STEVENS.

Bacon.—Throughout the month the English markets for bacon and hams have been depressed Supplies from most countries have been in excess of the demand, and prices have been reduced with a view to increasing the trade. Grocers, however, have not reduced their prices to any extent to the consuming public, as they feel that the reduction is of only a temporary nature, brought about chiefly by the heavier arrivals from Denmark, and a reaction may take place in the near future, present prices not being remunerative to the curers

By the end of the month most markets showed a firmer tone, and it is thought by many dealers that the lowest prices for the season have been reached The fall in prices for the month averaged from 4*s*. to 8*s*. per cwt., the biggest reductions being on the leanest selections, bringing prices more into line with quotations current at the same time last year.

The trade in American bacon and hams has been exceptionally small for the month, on account of the proportionately lower prices current for Danish and Dutch long sides.

Contracting with the United States of America, which is usual at this time of the year, is at a standstill, American packers demanding

prohibitive prices, asserting that they can readily realise their figures from their home trade, and that hogs will cost them higher prices in the future, although at the end of the month stocks of cut meats in the cellars of the packers had increased, they were below the average.

At Chicago during the month prices for hogs ranged from \$8.20 to \$8 75, against \$7 30 to \$8.70 last year, and \$5 75 to \$6 50 two years ago.

The supply of pigs to the English curers is still below that required. Prices are kept down by the cheaper Continental goods referred to above, which make it impossible for the English curers to dispose of their products on a profitable basis

Shipments from Canada continue very small, and local packers report that the prices realised in England for their product show a loss.

Cheese—There has been another unsatisfactory month's trading in cheese The demand for Canadian makes has been exceptionally small, as the arrivals from New Zealand continue heavy, and lower prices have been accepted to induce a freer consumption, making the latter description the better value. Although the prices for Canadian makes show little change on the month, some descriptions of New Zealand makes are 3*s*. per cwt cheaper, leaving quotations for both Canadians and New Zealands 5*s* to 6*s* per cwt higher than at the same time last year.

Arrivals from New Zealand will continue heavy, and although shipments from Montreal will be very small for the next two months, it is believed by many that spot prices will not show much, if any, advance on current figures

Stocks of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) at the end of the month were 96,000 against 157,000 last year, and 139,000 two years ago

Stocks of New Zealand cheese at London and Bristol were 35,700 crates (two cheese in each) against 26,800 last year, and 16,200 two years ago

In the United States the markets are very firm, and Canadian cheese is there being purchased for consumption in America at a price which permits of business being done on a profitable basis in competition with the home product.

From the opening of the season until the middle of February, the decrease in shipments from Canada amounted to 145,584 cheese in comparison with the same period of last year

The demand for English cheese continues good, but in some cases prices are a little easier.

Butter—The comparatively mild weather has not been conducive to a good consumption of butter Prices have fluctuated during the month, but on account of diminished arrivals from Australia, the various descriptions from that Colony were making higher prices at the end of the month, and as arrivals from now forward will be less, it is anticipated that prices will be higher in March.

The demand for best grades of New Zealands has only been moderate, but with the firmer markets for best Australians, the former description will doubtless command more attention from buyers during March.

The make of butter in Denmark continues in excess of last year, and the absence of orders from Germany for Danish butter leaves more to be exported to England

With the exception of Danish, which is about 7*s*. to 8*s*. per cwt. cheaper, prices generally for imported butter were about the same as during February of last year.

Unit Prices of Artificial Manures. Statement of cost to the purchaser of 1 per cent. per ton of Nitrogen, Soluble and Insoluble Phosphates, and Potash derived from

	London.	King's Lynn.	Hull.	Newcastle.
	s. d	*s. d*	*s d.*	*s d*
Nitrogen from :				
Sulphate of Ammonia 95% pure	13 3	13 3	13 1	13 2
Calcium Cyanamide ...	11 10	11 10	11 10	12 3
Nitrate of Soda pure... ... 95%	14 10	14 7	14 4	14 10
Nitrate of Soda pure... ... 90%	—	—	—	—
Nitrate of Lime	15 10	16 3	15 4	15 4
Soluble Phosphates from :				
Superphosphate 35%	1 8	1 7	1 9	1 10½
,, 33%	1 8½	—	1 9	1 10
,, 30%	1 8½	1 8	1 9½	1 11
,, 26%	1 10	1 9	1 11	2 1
Dissolved Bones	2 6	2 7	2 5	2 5
Allowed for Nitrogen	*18 0*	*18 2*	*17 3*	*17 0*
Allowed for Insol. Phos	*1 10*	*1 11*	*1 10*	*1 9½*
Insoluble Phosphates from :				
Basic Slag	1 6	—	1 6	1 3
Bone Meal	1 7½	1 7	1 5½	1 6
Allowed for Nitrogen	*15 7*	*15 3*	*14 1*	*14 6*
Steamed Bone Flour ...	1 4	1 6	1 4	1 5
Allowed for Nitrogen	*12 9*	*14 0*	*13 0*	*13 6*
Potash from :				
Kainit	4 1	3 11	4 0	4 3
Sulphate of Potash ...	4 7	4 3½	4 5	4 11
Muriate of Potash ...	3 11	3 7	3 8	4 0
Potash Salts	—	—	—	—

NOTE.—These unit prices are based on the probable retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified. They are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the per-

various sources, at certain Ports and Manufacturing Centres, for March, 1914.

Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
13 2	12 10 93% pure.	12 11 93% pure.	13 7	12 11	13 8
—	11 10	—	11 11	11 10	11 10
14 6	13 7	13 10	15 7	14 9	14 6
—	—	—	—	—	—
—	—	—	15 8	15 8	15 6
1 10½	1 9½	1 8½	1 10	1 9½	1 10
—	1 9½	1 8½	1 10½	1 10	1 10½
1 11	1 9½	1 8½	1 10½	1 10	1 10½
2 1	1 11	1 10	2 0	2 0	2 0
2 6	2 6½	2 6½	2 7	2 7	2 8
17 7	*18 3*	*18 4*	*18 7*	*18 5*	*18 10*
1 10	*1 11*	*1 11*	*2 0*	*1 11*	*2 0*
—	1 3	—	1 5	1 7	1 7½
1 7	1 6½	1 6	1 6	1 5	1 8
15 3	*14 7*	*14 6*	*13 7*	*13 8*	*15 6*
1 5	—	—	1 3	1 4½	1 5
13 8	—	—	*13 2*	*13 5*	*13 10*
4 3	4 3	4 4	3 6	4 4	4 4½
4 10	4 5½	4 6½	4 9½	4 11	4 9
4 0	3 8½	—	—	4 2½	4 4
3 3½	—	—	—	—	—

centages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and re-bagging the ingredients, bags, and loss of weight.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in February and January, 1914.

(*Compiled from Reports received from the Board's Market Reporters.*)

Description	February. First Quality.	February. Second Quality.	January. First Quality.	January. Second Quality.
FAT STOCK :—	per stone *	per stone.*	per stone *	per stone.*
Cattle :—	*s. d*	*s d.*	*s. d*	*s. d*
Polled Scots	9 2	8 9	9 1	8 8
Herefords	9 0	8 6	9 0	8 5
Shorthorns	9 0	8 4	8 10	8 2
Devons . .	8 11	8 3	9 0	8 3
Welsh Runts .	9 3	8 7	8 10	8 5
	per lb *	per lb *	per lb *	per lb *
	d	*d*	*d*	*d.*
Veal Calves .	9½	8¼	9¼	8¼
Sheep :—				
Downs	10	9½	10	9
Longwools ...	9¾	8½	9¾	8¾
Cheviots ...	10½	9¼	10¼	9½
Blackfaced ...	10½	9¾	10¼	9½
Welsh	10	9¼	9¾	9
Cross-breds . .	10	9	10	9
	per stone.*	per stone *	per stone *	per stone.*
Pigs :—	*s. d*	*s d.*	*s d*	*s. d.*
Bacon Pigs	8 4	7 10	8 2	7 9
Porkers	9 0	8 6	9 0	8 7
LEAN STOCK :—	per head	per head	per head	per head
Milking Cows :—	*£ s*	*£ s.*	*£ s*	*£ s.*
Shorthorns—In Milk	24 0	20 4	24 5	20 7
,, —Calvers .	23 6	19 10	22 10	18 18
Other Breeds—In Milk . .	20 13	17 16	21 16	17 16
,, —Calvers .	—	16 0	—	15 10
Calves for Rearing . ..	2 11	1 19	2 12	1 19
Store Cattle :—				
Shorthorns—Yearlings ...	11 18	10 7	11 13	10 5
,, —Two-year-olds	15 17	14 6	15 10	13 15
,, —Three-year-olds	19 6	16 15	19 7	16 12
Herefords —Two-year-olds..	18 5	16 10	17 4	15 3
Devons— ,,	16 7	14 13	15 5	13 3
Welsh Runts— ,,	17 6	—	—	—
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	*s. d.*	*s. d*	*s d.*	*s. d.*
Downs or Longwools ...	51 0	43 9	48 9	42 6
Store Pigs :—				
8 to 12 weeks old	27 6	21 6	26 5	20 4
12 to 16 weeks old	40 3	31 5	39 11	30 2

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in February, 1914.

(Compiled from Reports received from the Board's Market Reporters.)

Description	Quality	Birmingham		Leeds.		Liverpool		London.		Manchester.	
		per cwt		per cwt		per cwt		per cwt		per cwt.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
BEEF:—											
English	1st	59	0	58	6	60	0	62	0	61	0
	2nd	54	6	56	6	56	6	58	0	57	6
Cow and Bull	1st	52	6	53	6	51	6	49	0	53	0
	2nd	47	0	49	0	43	6	44	6	46	6
Irish: Port killed	1st	—		54	6	59	0	58	6	58	6
	2nd	—		52	0	55	6	56	0	55	0
Argentine Frozen—											
Hind Quarters	1st	43	6	44	6	44	6	42	0	44	6
Fore ,,	1st	39	0	38	6	38	6	37	6	38	6
Argentine Chilled—											
Hind Quarters	1st	49	6	48	6	48	0	49	6	48	0
Fore ,,	1st	40	0	40	0	39	0	39	6	39	0
Australian Frozen—											
Hind Quarters	1st	41	6	42	0	42	6	41	0	42	6
Fore ,,	1st	38	6	37	6	37	6	37	6	37	6
VEAL:—											
British	1st	84	0	73	6	83	6	79	6	81	6
	2nd	77	0	70	0	73	0	73	6	74	6
Foreign	1st	—		—		—		83	0	--	
MUTTON:—											
Scotch	1st	—		—		88	0	77	6	85	6
	2nd	—		—		83	6	73	0	83	6
English	1st	74	6	79	6	82	6	71	0	80	6
	2nd	66	6	75	0	78	0	66	6	74	6
Irish: Port killed	1st	—		—		80	6	72	6	—	
	2nd	—		—		76	0	65	6	—	
Argentine Frozen	1st	41	0	42	0	42	0	41	0	42	0
Australian ,,	1st	39	6	39	6	38	6	39	6	38	6
New Zealand ,,	1st	—		—		—		45	0	—	
LAMB:—											
British	1st	104	0	116	6	—		101	6	—	
	2nd	97	0	—		—		92	0	—	
New Zealand	1st	60	0	—		59	6	62	0	59	6
Australian	1st	56	6	56	0	54	0	56	0	54	0
Argentine	1st	54	0	56	0	53	6	56	6	54	0
PORK:—											
British	1st	76	0	73	0	75	0	68	0	79	6
	2nd	70	6	70	0	66	0	62	6	71	6
Foreign	1st	69	0	63	0	67	6	63	6	67	0

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1912, 1913 and 1914.

Weeks ended (*in* 1914).	WHEAT. 1912.	WHEAT. 1913	WHEAT. 1914	BARLEY. 1912	BARLEY. 1913	BARLEY. 1914	OATS. 1912.	OATS. 1913	OATS. 1914.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan 3 ..	33 2	30 5	31 1	33 3	28 6	26 2	20 7	19 10	18 2
,, 10 ..	33 1	30 3	30 11	33 0	28 4	25 11	20 8	19 2	18 4
,, 17 ...	33 4	30 5	31 0	33 3	28 6	26 0	20 11	19 4	18 6
,, 24 ..	33 7	30 11	30 11	33 1	28 10	26 3	21 1	19 4	18 11
,, 31 ...	33 8	31 1	31 1	32 10	28 11	26 6	21 3	20 2	19 1
Feb 7 ..	34 0	31 0	31 0	33 2	28 10	26 7	21 4	20 1	18 9
,, 14 ...	34 4	30 9	31 0	32 10	29 1	26 7	21 7	20 2	18 11
,, 21	34 6	30 11	31 0	32 8	28 8	26 7	21 9	20 7	18 11
,, 28 ...	34 1	31 0	31 0	32 0	28 6	26 6	21 6	20 4	18 11
Mar 7 ..	34 1	31 3	31 5	31 7	28 5	26 2	21 8	20 0	18 9
,, 14 ...	34 0	31 1		31 2	27 11		21 8	20 2	
,, 21 .	34 1	31 1		31 10	28 6		21 9	19 11	
,, 28	34 4	31 3		30 3	27 6		21 8	19 7	
Apl 4 ...	34 10	31 4		30 9	27 0		21 11	19 2	
,, 11 ..	35 4	31 3		30 2	27 8		22 1	19 2	
,, 18 ...	36 7	31 6		29 11	26 11		22 4	18 10	
,, 25 ...	37 10	31 8		30 4	26 7		22 9	19 3	
May 2 ...	38 1	32 2		30 2	25 11		23 1	19 6	
,, 9 .	37 11	32 6		31 1	25 9		23 7	19 6	
,, 16 ..	37 8	32 10		31 2	25 4		23 7	19 9	
,, 23 ...	37 2	32 10		31 1	25 3		23 7	19 11	
,, 30 ...	36 10	32 7		30 0	26 1		23 9	20 1	
June 6 ..	36 11	32 10		29 11	26 2		24 0	19 8	
,, 13 ...	37 0	32 8		30 8	24 7		23 10	20 2	
,, 20	37 5	32 8		30 8	23 10		24 0	19 8	
,, 27 ..	37 10	32 8		30 2	24 3		23 11	19 1	
July 4 ...	38 2	33 1		31 7	25 2		23 11	21 0	
,, 11 ...	38 3	33 4		30 2	25 10		24 1	19 4	
,, 18	38 10	33 6		30 9	24 9		24 6	20 5	
,, 25 ..	38 9	33 10		30 9	24 1		23 4	20 8	
Aug. 1 ...	38 4	34 1		28 6	24 5		22 2	20 3	
,, 8 .	39 2	34 1		30 7	24 9		22 4	19 0	
,, 15 ...	38 2	34 3		28 3	24 7		21 8	18 7	
,, 22 ...	35 6	33 7		28 1	26 5		20 10	18 8	
,, 29 ...	34 10	32 7		28 6	29 0		20 8	17 10	
Sept 5 ...	35 1	31 11		29 9	30 11		21 8	17 8	
,, 12 ...	33 5	31 9		29 0	31 5		20 5	18 0	
,, 19 ..	32 7	31 7		29 6	30 9		19 10	17 11	
,, 26 ...	31 7	31 6		29 9	30 1		19 5	17 9	
Oct 3 .	31 8	31 3		29 7	29 9		19 8	17 10	
,, 10 .	31 10	31 0		30 4	29 1		19 5	17 10	
,, 17 ...	32 2	30 11		30 11	28 8		19 9	17 9	
,, 24 ...	33 1	30 7		31 6	28 7		19 10	18 0	
,, 31	33 4	30 1		31 10	28 2		20 1	17 9	
Nov. 7 ...	33 1	30 0		31 11	28 1		19 11	17 9	
,, 14 ...	32 10	30 1		31 2	27 8		19 9	17 11	
,, 21 ...	32 1	30 4		30 11	27 5		19 11	18 1	
,, 28 ...	31 9	30 9		30 8	27 0		19 8	18 4	
Dec 5 ..	31 0	31 2		29 11	26 8		19 6	18 4	
,, 12 ...	30 8	31 2		29 2	26 5		19 3	18 6	
,, 19 .	30 7	31 2		28 11	25 11		19 1	18 5	
,, 26 ..	29 10	31 0		28 6	25 10		19 2	18 4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates. Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

—		Wheat. 1913		Wheat. 1914		Barley. 1913.		Barley. 1914.		Oats. 1913.		Oats. 1914.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d	s	d
France:	January ...	47	2	45	1	30	4	28	4	24	0	22	3
	February ..	47	3	45	5	30	2	28	5	23	11	22	3
Paris:	January ..	48	9	45	7	31	3	29	5	23	11	21	7
	February ...	47	6	45	7	31	0	29	2	23	6	21	0
Belgium:	January ..	34	7	32	2	30	5	25	5	22	8	20	8
Berlin:	January ..	43	0	40	11	—		—		24	0	21	2
Breslau:	January ..	37	10	38	6	29	5*	27	6*	21	10	19	11
						26	9†	25	3†				

* Brewing. † Other

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of February, 1913 and 1914.

—	Wheat 1913		Wheat 1914.		Barley. 1913		Barley. 1914		Oats. 1913.		Oats. 1914.	
	s.	d.	s.	d.	s.	d	s.	d.	s.	d.	s.	d.
London	31	5	32	2	30	3	26	8	23	3	20	1
Norwich	31	7	30	8	27	6	26	0	20	8	18	11
Peterborough	28	5	30	4	27	3	25	11	17	2	18	7
Lincoln	29	0	31	1	29	6	27	1	18	2	19	5
Doncaster	28	10	31	2	27	6	26	9	19	7	19	2
Salisbury	30	9	30	3	31	2	25	4	20	10	19	0

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in February, 1914.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol. First Quality	Bristol. Second Quality	Liverpool. First Quality	Liverpool. Second Quality	London. First Quality	London. Second Quality
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb	per 12 lb	per 12 lb	per 12 lb	per 12 lb	per 12 lb
British	16 0	14 3	—	—	16 0	14 6
	per cwt	per cwt.	per cwt	per cwt	per cwt	per cwt
Irish Creamery—Fresh	—	—	—	—	—	—
„ Factory .. .	105 0	98 0	105 0	97 0	105 0	100 0
Danish	—	—	125 6	122 0	125 0	122 0
French	—	—	—	—	134 6	130 0
Russian	112 0	106 6	—	—	112 6	107 6
Australian	116 0	112 6	114 6	112 0	116 6	112 6
New Zealand	119 6	116 0	117 0	114 6	119 0	116 0
Argentine	114 6	112 0	114 6	111 6	114 0	112 0
CHEESE:—						
British—						
Cheddar	84 0	75 6	82 6	79 0	82 0	77 0
			120 lb	120 lb	120 lb.	120 lb
Cheshire	—	—	88 6	82 6	84 0	78 0
			per cwt	per cwt	per cwt	per cwt
Canadian .. .	70 0	67 6	70 0	67 0	71 0	68 0
BACON:—						
Irish (Green) ...	79 0	74 6	71 0	66 0	79 6	76 0
Canadian (Green sides)	68 6	66 6	66 0	64 0	69 0	66 6
HAMS:—						
York (Dried or Smoked)	130 6	124 0	—	—	126 0	120 0
Irish (Dried or Smoked)	—	—	—	—	124 6	118 6
American (Green) (long cut)	69 0	66 0	67 6	64 6	71 0	68 0
EGGS:—	per 120.	per 120	per 120	per 120	per 120.	per 120
British	11 3	—	—	—	13 11	12 8
Irish	13 1	12 7	13 3	12 5	13 10	11 7
Danish	—	—	—	—	13 7	11 6
POTATOES:—	per ton	per ton	per ton.	per ton	per ton	per ton
British Queen	76 0	66 0	—	—	75 0	66 0
Edward VII.	90 0	73 6	51 6	—	76 0	63 6
Up-to-Date ...	75 6	68 0	45 0	40 0	70 6	61 0
HAY:—						
Clover	—	—	88 0	70 0	76 0	68 6
Meadow	—	—	—	—	68 6	61 0

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	FEBRUARY.		TWO MONTHS ENDED FEBRUARY.	
	1914	1913	1914.	1913
Anthrax:—				
Outbreaks . ..	69	59	167	119
Animals attacked .	75	62	177	133
Foot-and-Mouth Disease:—				
Outbreaks	5	—	5	—
Animals attacked	31	—	31	
Glanders (including Farcy):—				
Outbreaks . ..	11	16	20	31
Animals attacked	20	30	46	100
Parasitic Mange:—				
Outbreaks ..	330	326	748	748
Animals attacked .	567	626	1,426	1,636
Sheep-Scab:—				
Outbreaks	39	34	116	91
Swine Fever:—				
Outbreaks	250	127	487	302
Swine Slaughtered as diseased or exposed to infection ...	2,633	1,197	4,515	3,477
Tuberculosis:—				
Number of Premises notified .	435	*—	907	*—
Number of bovine animals notified as for slaughter .	463	*—	957	*—

* The Tuberculosis Order came into operation on 1st May, 1913.

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE	FEBRUARY.		TWO MONTHS ENDED FEBRUARY.	
	1914	1913	1914.	1913.
Anthrax:				
Outbreaks	—	—	—	—
Animals attacked ...	—	—	—	—
Foot-and-Mouth Disease:—				
Outbreaks	1	—	2	—
Animals attacked . .	8	-	28	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	8	15	25	64
Sheep-Scab:—				
Outbreaks	100	78	218	167
Swine Fever:—				
Outbreaks	19	11	34	35
Swine Slaughtered as diseased or exposed to infection ...	130	55	224	179

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(APRIL, 1913, TO MARCH, 1914.)

[*NOTE—References to Insects and Fungi are indexed under the headings "Insects" and "Fungi" only, to Weeds under the heading "Weeds" only, to Diseases of Animals under the heading "Diseases of Animals" only, and to Import and Export Regulations under the heading "Import Regulations" only*]

The names of the research and experiment stations at which the principal experiments summarised in the *Journal* have been conducted are indicated in italics, thus —(*Rothamsted*) In the case of experiments conducted abroad, the name of the country is given.

Articles or reports on the following subjects appear in the *Journal* each month, and are not separately indexed —Notes on the Weather, Notes on Agricultural Labour in England, Notes on Crop Conditions in England and Wales, Reviews of the Corn Markets, the Live and Dead Meat Trade, and the Provision Trade, Prices of Agricultural Produce, Outbreaks under the Diseases of Animals Acts, Prevalence of Animal Diseases on the Continent, Lists of Additions to the Board's Library, and Selected Contents of Periodicals

Supplement

TO

The Journal

OF THE

BOARD OF AGRICULTURE

SUPPLEMENT No. 10. JULY, 1913.

FURTHER REPORT

ON THE

ISLE OF WIGHT BEE DISEASE

(*Microsporidiosis*)

G. S. GRAHAM-SMITH, M.D.
H. B. FANTHAM, D.Sc., B.A., F.Z.S.
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G. W. BULLAMORE.
W MALDEN, M.D.

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SUPPLEMENTS TO THE JOURNAL OF THE BOARD OF AGRICULTURE

No. 1	Report on Agricultural Education in the United States	Jan., 1908
No 2 —The Food of Some British Birds .		Dec., 1908
No 3 —Reports on the Work of the International Agricultural Institute		April, 1910
No. 4.—Wheat Papers Read at a Meeting of the British Association at Winnipeg, 1909		June, 1910
No 5 —Influence on the Production of Mutton of Manures Applied to Pasture ...		Jan., 1911
No 6 —Report on the Work of the International Agricultural Institute		July, 1911
No 7 —The Interpretation of the Results of Agricultural Experiments		Nov., 1911
No 8 —Report on the Isle of Wight Bee Disease		May, 1912
No. 9.—Notes on Kerry Woods, illustrating Methods of Collecting and Utilising Information for a Forest Survey ...		Aug., 1912
No 10.—Further Report on the Isle of Wight Bee Disease		July, 1913

THE present Report on the Epidemic among Bees in Great Britain, popularly known as Isle of Wight Disease, has been prepared by Dr. Graham Smith, in conjunction with Dr. Fantham and Dr. Annie Porter, Mr. Bullamore and Dr. Malden. It is the fourth report on the subject which has been published by the Board of Agriculture and Fisheries. The first, prepared by Mr. A. D. Imms, was published in the Journal of the Board of Agriculture for June, 1907. The second, written by Dr. Malden, appeared in the Journal for February, 1909. The third, by the authors of the present Report, was published as Supplement No. 8 to the Journal, and was in effect an interim report on the investigation, the final results of which are discussed in this Supplement. References to the subject were also made in the Report of the Intelligence Division of the Board of Agriculture and Fisheries, Part II., for the years 1909–10, 1910–11, and 1911–12.

Arrangements have been made for further investigation into the character of the disease with the object of finding some effective remedial or preventive treatment, and the Board would be glad if all bee-keepers wishing to assist would communicate with them. In no case should bees, either alive or dead, be sent unless asked for, and then only in accordance with directions which will be supplied. Letters should be addressed to The Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W. Letters so addressed need not be stamped, but the words "Bee Disease" should be written across the top left-hand corner of the envelope.

BOARD OF AGRICULTURE AND FISHERIES,
4, WHITEHALL PLACE,
LONDON, S.W.

July, 1913

CONTENTS

FURTHER REPORT ON THE ISLE OF WIGHT BEE DISEASE

(Microsporidiosis).

INTRODUCTION.

G. S. GRAHAM-SMITH, M.D.

THE results of investigations which had been carried out for the Board of Agriculture and Fisheries on the "Isle of Wight" Bee Disease during 1911 were published in a Supplement (No. 8) to this *Journal*, May, 1912. The present Report contains the results of observations made by the same investigators since that date.* These further observations have confirmed in all essential respects the views previously put forward of the cause of the disease, and of the mode of spread and the life history of the parasite, *Nosema apis*. The history, symptoms, and relation of *Nosema apis* to the disease were so fully dealt with last year in the sections of the Report devoted to them that no further remarks on these subjects need be made. Drs. Fantham and Porter have confirmed their observations on the life history, but add the results of some further investigations.

Much work has been done on experimental infection under various conditions, but only those experiments are quoted which seem to throw some new light on the disease. Particular attention has been paid to the reports published on drug treatment of the disease, and some experiments have been made on the subject. No bacterium producing a specific infection in bees has yet been isolated.

In conclusion, a summary of all the work hitherto done

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* All the observations made by Drs. Fantham and Porter are collected in Section I., those by Dr. Graham-Smith and Mr. Bullamore in Section II., and those by Dr. Malden in Section III.

has been added. In an appendix is given a short account of Pasteur's researches on *Pébrine*, an allied disease of silkworms caused by *Nosema bombycis*.

Though pébrine differs in one important respect from microsporidiosis of bees, in that in pébrine hereditary infection is an important mode of spread, the two diseases resemble each other so closely in all other particulars that a comparison of them is most instructive. Both were present long before they were recognised as specific diseases; both were attributed at first to inexperience and neglect, and later to poisoned food; hypotheses and suggestions concerning both were subsequently innumerable; in both diseases the symptoms are numerous and variable; in both numerous specifics have been recommended, each being strongly advocated for a time and then discarded; in both, partially immune insects and "carriers" infected with spores have been found; in both the finding of spores in apparently healthy insects has been urged as a proof against the pathogenic action of *Nosema*; in both contamination of food with infected fæces seems to play an important part; the spores of both *Nosema apis* and *Nosema bombycis* appear to be injured by drying; finally, both have been fostered by trade.

Though it is highly probable that adult bees suffer at times from infectious diseases other than microsporidiosis, there can be little doubt that the widespread epidemic of recent years is mainly due to *Nosema apis*, and that preventive rather than curative measures will have to be adopted in order to limit its ravages. Future investigations should be directed, therefore, mainly to perfecting the means of prevention.

SECTION I.

H. B. FANTHAM, D.Sc., B.A., F.Z.S., and
ANNIE PORTER, D.Sc., F.L.S.

SINCE the appearance of the report in May last year we have continued our researches on the life history of the parasite, *Nosema apis*, on the methods whereby infection is acquired, and on further preventive measures which may be of local service.

The season 1912–13 was somewhat abnormal, and was reflected in the condition of the bees. The lack of sunshine enfeebled them to some extent, and the pollen supply was also less abundant, while there were fewer opportunities of storage. The disease (microsporidiosis), in practically every case, ran an acute course, and the death of the host prevented the final stages of development of the parasite in many cases. The bees died of microsporidiosis owing to the action of the multiplicative stages of the parasite, and comparatively few *Nosema* were able to reach the spore stage. The above conclusion was deduced from an examination of 75 sets of worker bees (mostly naturally infected), 14 queens, 6 sets of drones, and 3 sets of larvæ; 5 sets of comb, 4 of pollen, 5 of honey, and 2 of excrement. A number of foundations obtained either by direct purchase or from friends who had bought them, were also examined. Insects obtained from hives and examined included ants, wasps, earwigs, and wax moths.

(*a*) LIFE HISTORY OF *Nosema apis*.

With regard to the life history of the parasite, *Nosema apis*, the past season's work has simply confirmed the work of previous years, as detailed in the previous report (Supplement No. 8, pp. 57–78). We, therefore, briefly recapitulate

this, and emphasise the points in which slight differences occur.

The most conspicuous form in the life history of the parasite consists of the spore, which is taken up by the bees with their food or drink or during the various cleansing processes undertaken in the hive by the bees either for one another or for themselves. When a spore is ingested, it usually passes to the chyle stomach of the bee before any change occurs. The spore becomes softened in the chyle stomach, and the thread-like, polar filament contained within the spore is forcibly ejected and anchors the spore temporarily to the wall of the gut. A small amœbula then issues from the sporocyst. This organism may have one or two nuclei, two being commoner. Sometimes the two nuclei fuse; more often we find that division of the body substance occurs, and two minute, uninucleate amœbulæ are produced. Occasionally precocious division of the nuclei (which are sporoplasmic nuclei) may occur before the amœbula leaves the sporocyst. The daughter amœbulæ can divide again, for we have found clusters of four or more small forms in smears of the gut wall. The amœbulæ, which are known as planonts (wanderers), soon penetrate between the cells of the gut. The majority enter the epithelial cells, but others pass between them into the body space beyond, and reach the hæmocœlic fluid. These hæmocœlic forms were far less frequent in 1912–13 than they were in 1911–12, and then they were usually found in bees heavily infected with spores.

Multiplication.—When the planont enters the epithelium of the gut it loses its activity, becomes rounded and motionless, and grows steadily at the expense of the host cell. This growing, feeding stage, or trophozoite of *N. apis*, when present in numbers, as it was in the season 1912–13, is sufficient to kill the bee. Usually, after attaining a certain size, the parasite proceeds to divide into two. In some cases a second division only occurs, so that four daughter forms or meronts are produced from one parent. In other cases the division is repeated frequently, so that considerable numbers of meronts result, and consequently colonies of parasites are found in the infected cells. Comparing the results of the season 1912–13 with those of 1911–12 (Supplement No. 8,

pp. 60–63) we found a relative increase in the number of trophozoites that produce four meronts only. Our experiences from 1906 onwards show that for those years multiple division was much more common than quadruple. Such is still the case, but at the same time we found more "nests" of four meronts in 1912–13 than we did previously. Also, chains of meronts were seen but very infrequently. The large forms of *N. apis* which are multinucleate and produce a number of spores without previous direct cleavage into meronts, have not been so numerous this year. Referring to our previous records, we find that bees which contained many spores also had these large forms of *N. apis* often wedged between the epithelial cells, and we consider that the conditions, which have prevented spore formation by bringing about the death of the bees, are also responsible for the fewness of the large plasmodial forms.

Spore Formation.—No matter by what means the uninucleate meronts are formed, after a period of active growth they commence to differentiate into spores. Each meront becomes, then, a pansporoblast or sporont. Active division of the nucleus ultimately results in the production of five nuclei. At the same time the protoplasm of the spore undergoes change of position. A large vacuole forms at one end, and a smaller one at the other. This latter is known as the anterior end, and its vacuole is called the polar capsule. The cytoplasm around it is somewhat firmer at its edge, and a long thread gradually extends downwards from near the spore wall, passes through the polar capsule into the posterior vacuole, and coils up there. This thread is the polar filament. Of the five nuclei produced within the sporoblast, one regulates the formation of the polar capsule and filament, and is termed the pole capsule or capsulogenous nucleus. Two of the remaining four nuclei pass to the periphery of the sporoblast. They usually become filamentous, and under their influence the sporoblast secretes a coat or sporocyst. These nuclei are known as parietal, valvular, or sporocyst nuclei. The cytoplasm, now termed the sporoplasm, is disposed roughly in a girdle around the sporocyst, and contains two nuclei, termed sporoplasmic nuclei. The sporoblast has now become a spore, and the final stages of nuclear division given above are fre-

quently obscured by the increasing thickness of the chitinous sporocyst, which is ultimately white, shining, and very opaque.

The final result, then, is that one pansporoblast, one sporoblast, and one spore are successively produced from a single uninucleate meront.

Ultimately the spores are set free from the host cells, which are shed entire into the gut and burst there. Consequently, all stages in the life history of *Nosema apis* cán be found in smears of the gut of a heavily infected bee, since epithelial cells containing all stages are shed. Spores occur in the excrement of infected bees, though meronts and even pansporoblasts can seldom be found. The young stages of *N. apis* are very fragile and perish on leaving the bee. They also decompose with great rapidity when their host dies. Spores of *Nosema* can be detected in a dead bee, but the young forms cannot, unless the bee has only just died.

The life-cycle outlined briefly above is that of the parasite in the gut of the host, and so far as its behaviour is concerned we have found no difference whether the parasite were present in larvæ, in young or old worker bees, in queens, or in drones.

It will thus be seen that during 1912–13 little has been added to our knowledge of the cycle of the parasite in the bee, but that the former results have received full confirmation.

Distribution of the Parasite within the Bee.

As we previously stated, *Nosema apis* is a specialised organism, restricted almost entirely to the alimentary tract of the bee. During the season of 1912–13 the examination of over three thousand bees either recently dead or dying of "Isle of Wight" disease, fully justified our statements of previous years.

In a few cases spores were found in the œsophagus of bees, but this was infrequent. The crop or honey stomach as a rule was uninfected, but in five sets large numbers of young stages of *N. apis* were found in the honey stomachs of the bees examined. These young stages in all the sets consisted of small trophozoites, a few of which showed signs of division.

On the whole, we considered these to be cases of very early infection. The chyle stomach (which is more easily attacked than the foregut, as it has a thinner, chitinous lining) was, as before, the chief seat of infection, and in a few cases its cells and those of the intestine teemed with young parasites. No infection of the lining cells of the colon or rectum occurred in the bees we examined during the season 1912–13.

Much attention was devoted to the examination of the salivary glands of the bee, in order to determine whether some stage in the development of the parasite might be found therein. Were such infection present, an additional means of spreading the disease might be demonstrated. Neither smear nor section gave any definite indications of such a stage, and up to the present we have found no trace of salivary infection, even in cases where the hæmocœl of the bee has contained parasites.

The possibility of a salivary development of *Nosema apis* on the same lines as those of the *Plasmodium* of malaria had been suggested. We have been able to find no such development. There does not seem to us to be much probability of such a development in the case of *N. apis*. The transference of malaria from person to person is brought about by the inoculation of the parasite by the stab of the mosquito after a necessary preliminary development of the parasite within the body of the insect. On the other hand, the transmission of *Nosema apis* is accomplished by the ingestion of spores of the organism derived from bees already infected. There is, then, no necessity for a stage of *Nosema* to be developed in the salivary glands of the bee.

The Malpighian tubules, as a possible seat of infection, also received much attention. In 1912–13 we found no case of infection of these important excretory organs, a result coinciding with our previous experiences, as we have only once found *Nosema* in a single Malpighian tubule of a bee during the last seven years (Supplement No. 8, pp. 69–70). We have, however, found an infection of a *Nosema* in the Malpighian tubules of three species of humble bees, in one species of a Hymenopteran living in sand hills in France, and also in a Stenichneumon. The *Nosema* was pathogenic to these Hymenoptera.

Wax glands were also examined in some detail, especially as wax containing *Nosema* spores was bought in the open market. The contamination of the wax was probably of fæcal origin, since the results of our examinations of this year confirm those of last year, no infection of the wax glands having been found.

The hæmocœlic fluid of bees was examined with great care. We have previously found young stages, and in some cases spores, of *Nosema* in the hæmocœlic fluid of very heavily infected bees which contained many spores in their food canals. During 1912–13 no bees containing very large numbers of spores were found by us, and only in one or two cases were there even young stages in the hæmocœlic fluid. The most heavily infected case was a large Italian queen, whose hæmocœlic fluid contained a fair number of meronts. The gut of this queen also showed meronts. No spores were found by us in any part of this queen, though they may have been present in the gut and have been discharged prior to our examination. Hæmocœlic infection, then, has been relatively uncommon, and cannot be considered as having much significance in connection with the numbers of bees that died during the season 1912–13. The great mortality appears to have been due to alimentary infection superadded to a lowered vitality resultant on weather conditions and the consequent impoverishing effect on pollen and nectar, which form the normal food of the bees.

The problem of hereditary infection is of vital importance. Should the queen be capable of transmitting the parasite to her eggs the larvæ would be born infected, and many preventive measures relating to the spread of the disease would be neutralised, as it is practically impossible to provide against the queen contracting infection.

During the season 1912–13 we examined fourteen queens, six being killed for purposes of examination, and the remainder being dead when received. Three more queens were examined, but as they came from a hive in which several queens were present, and two of the three had not been fertilised, they are not included in the above list. All the six queens killed by us had an infection of *Nosema apis* in their alimentary tracts. Five cases were slight, and one was a

moderately heavy infection. A very few spores were found in the chyle stomach of one queen, but in the other five the parasites present were young stages only. The queen in which mature spores occurred was a large Italian, and was interesting in that young stages of *N. apis* in "nests" of six to sixty occurred in the walls of her chyle stomach. Meronts were also found in her hæmocœlic fluid. Some of the nearly mature eggs in the ovaries showed minute bodies that resembled meronts, but the eggs were so far developed that it was practically impossible to decide whether the peculiar bodies mentioned were really meronts or were merely some of the migratory cells so common in insects. Dead queens were useless from the point of view of hereditary infection, as both the gut and the ovaries degenerated rapidly after death. Spores alone are capable of being identified in any bee that has been dead more than a short time, and then it may be impossible to determine the organ in which the spores were formed. At present, then, ovarian infection has not been decisively proved.

The drone has been shown to suffer from intestinal infection of *Nosema*, both by other workers and by ourselves. Many of the drones that we examined in the season 1912–13 were infected. Among the fifty drones examined, all those killed purposely for investigation showed young stages, and in addition a few contained spores. As one instance, fifteen drones were examined by us from one set, and all contained a moderate number of meronts and four had a few spores. Examination of the genitalia, however, gave negative results. Infected drones constitute a serious menace to the hive, since they soil comb, honey, and hive alike, and the worker bees that remove the infected excrement contract the disease in so doing. Further, as drones visit any hive in their neighbourhood, they may spread the disease from hive to hive. From what we have been able to observe up to the present, there does not seem much evidence that queens become infected by the drones in their mating flights. Contamination of the queen within the hive is another matter.

We regret that we have not been able to examine freshly laid eggs, and also that no queen containing numerous *Nosema* spores was available for examination. The condition necessary for the migration of planonts into the hæmocœlic

fluid, whence they are carried to other organs, appears to be that very large numbers of parasites should be present in the gut. Further, as hæmocœlic infection does not seem to occur until partial exhaustion of the gut is followed by the formation of spores, the conditions during the season 1912–13 were not such as to cause anticipation of hæmocœlic, and consequently genitalian, infections.

Larvæ, both young and approaching maturity, were examined. One set of fairly mature larvæ showed a few meronts in the walls of their chyle stomachs, but none of the immature bees that we examined contained fully formed spores. In the case just mentioned, pollen contaminated with fæcal matter was present, both in sealed and unsealed pollen cells from the hive, and it seems probable that this was the source of infection of the brood. On another occasion three young bees about to emerge as imagines were received dead. One of these three showed a few spores which may have been ingested or may have been formed from meronts in the gut wall. As these pupæ had been too long dead, it was impossible to discriminate with certainty between these two modes of infection, as all young stages, if formerly present, had perished, and the gut itself was merely a darkish, pulpy, structureless lump. One further method of larval infection was suggested by watching some of the nursing bees feeding the grubs. Assuming that the nursing bees were infected, they might serve as active carriers of disease to the younger generation, since not only spores but possibly planonts and meronts could be regurgitated along with the food destined for the larvæ. Planonts thus regurgitated, if swallowed after regurgitation, would be able in all probability to infect the gut cells of the larvæ. We were able to observe the movements of the amœbulæ for two hours after their removal from the bee, and it seems reasonable to suppose that they could maintain their vitality better in their natural environment, the alimentary canal of the bee, than in a microscopical preparation.

Undoubtedly, the larvæ of bees can become infected with *Nosema apis* and die as the result of the infection, but we think that the greater number of larvæ die as a result of chilling due to the diminution in numbers of the adult

members of the colony following the action of *Nosema*. The contamination of their food, whether directly or indirectly by the adult bees, aids in disseminating the infection, but the development of the host and the parasite seems to progress simultaneously, and the protozoön is more fatal to mature than to immature insects.

(*b*) PARASITE CARRIERS.

During the early part of the season large numbers of bees dying of young stages of *Nosema apis* (meronts chiefly) were examined. Very few bees contained spores. In January, 1913, a detailed examination of 225 dead bees from hives of one district was made by us. Six contained spores, but in small numbers. These bees possibly were parasite carriers, the majority of whose spores had been shed.

Several sets of bees, both alive and dead, were received in February. In each set several contained spores, while all received alive contained young stages of *N. apis*. These bees were the sole survivors of their respective hives, and one may infer that the relatively unharmed parasite carriers had survived the less or non-immune members of their communities.

In one case, a number of drones were expelled from the hive in February, 1913, and a large proportion of these drones contained a few spores. In the above cases it certainly seems that some parasite carriers are highly resistant, and this may explain the sudden outbreaks of disease among clean stock to which a parasite carrier gains access. One queen, a large Italian, again a survivor of a hive, certainly was a parasite carrier. She contained a few spores in her gut, but her chyle stomach and hæmocœlic fluid both contained numerous multiplicative stages of the parasite. As queens survive several generations of workers, the infection of one queen is more serious than that of one worker so far as maintaining the activities of the parasite are concerned, though the numbers of the workers render them the more important in spreading disease rapidly.

The investigation of the natural methods of the spread of infection other than by feeding or by the agency of insects has been prevented to a very large extent by the weather

conditions. Much rain washed the spores into the soil, and also obliterated the tracks of diseased bees, as shown by their fæcal deposits. Excrement scraped in fine weather from outside hives has shown spores on a few occasions. Once, surface soil from near the alighting board of a diseased hive showed *Nosema* spores. Tracking spores on vegetation under almost continuous rainy conditions, coupled with great scarcity of spores, has been practically impossible.

To sum up, infection is carried principally by means of contaminated food or drink, and parasite carriers apparently have had a considerable share in maintaining the disease during 1912–13. Ants, wasps, wax moths, and robber bees play a subsidiary part in carrying away spores which, voided elsewhere, may produce disease. The use of honey from infected hives as food for other bees, and of old comb and non-sterile foundations, also contributes to the production of outbreaks.

(*c*) EXAMINATIONS OF POLLEN, HONEY, AND WAX.

The infectivity or otherwise of pollen and honey stored in hives, or of the wax used therein, depends on the presence of *Nosema* spores usually derived from fæcal contamination.

Examination of Pollen from Hives.—Four sets of comb containing pollen cells were examined in the season 1912–13. One specimen showed considerable fæcal contamination, masses of semi-digested pollen being present, together with a very few spores of *N. apis.* The contamination was restricted to one area of the comb examined. The other specimens showed no spores in their contained pollen, though excrement was present on the wax outside.

Examinations of Honey from Combs.—The honey from the specimen wherein pollen contamination occurred also contained flecks of excrement. Certain cells showed this much more than others, and the appearance of the honey suggested the commencement of crystallisation. Such was not the case; the "nuclei" were merely suspended droplets of undigested and semi-digested pollen, together with an extremely small number of *Nosema* spores.

One set of honey, taken from a hive a month prior to disease being noticed, was examined. It seemed uninfected.

A second sample, taken when the bees had become greatly reduced in numbers, contained a good deal of excrement, but no spores were seen in it. A sample from a neighbouring hive, however, contained spores. It was subsequently ascertained that the second hive was the one in which disease was first detected by the owner. A great deal of robbing from this hive had occurred, and, according to the owner, this partly accounted for the spread of the disease.

Recently we received a sample of honey which to all external appearances was clean and good. The hive from which it was taken had died out. The dead bees, together with the greater part of the contents of the hive, had been burned, and only a small portion of honey from a part of the last frame was available. Examination showed that this run honey contained large numbers of *Nosema* spores, and so would be very dangerous if used for feeding bees.

Examinations of Wax.—As mentioned in the previous Report (Supplement No. 8, p. 55), combs were found capable of carrying infection in the form of spores of *N. apis*. Soiled comb was more frequently infected than clean comb. Comb containing pollen, and therefore rough, contained spores in a few cases in the season 1912–13. Some interesting results were found on examining certain new foundations. These were of wax, and superficially seemed quite clear and harmless. When they were ground with water and the resultant liquid was examined microscopically, pollen from clover, mallow, pine, marrow, and apple, all in a state of partial digestion, and a few *Nosema* spores, were found. The foundations, however, were put into use, and all the hives to which these waxes were supplied became extinct. No "Isle of Wight" disease was known in the neighbourhood previously. An inquiry was made as to the source of the infected foundations. It was found that it was the practice for certain collectors to melt down old comb either by sun heat or by warming it to the lowest temperature at which it would melt—one producer stating definitely that 120° F. was sufficient to melt the old comb. When melted the wax was run into moulds, and sold without any further precautions. A temperature of 120° F. has no effect on the *Nosema* spore other than to hasten its development. A temperature far above 120° F. is necessary

before the wax can be regarded as sterile, and foundations should be produced under conditions that render them harmless. The remarkable amount of trouble taken by bees who re-chew their wax and rearrange it repeatedly is a means whereby the *Nosema* spores can gain access to the alimentary canals of the bees. The use of old wax in cases where disease has existed is to be avoided as it may be contaminated. Further, it must be remembered that the spore-coat (sporocyst) of *Nosema* is resistant to very weak acids and alkalies. While not wishing to suggest that microsporidiosis is being widely disseminated by means of old comb made up as new foundations, we feel that too much care cannot be taken in the melting and cleansing of old comb.

(*d*) EXAMINATIONS OF CERTAIN INSECTS FOUND IN HIVES.

Work on this subject during the session 1912–13 was restricted to examinations of ants, the fly *Braula coeca* (popularly known as the "bee louse"), earwigs, wasps, and the lesser wax moth, *Achroea grisella*, L.

Ants.—During this season a few ants have been found with spores in passage through their intestines. But it was hardly to be expected that many spores would be found in ants which acquire them by robbing infected hives, when so few parasites appear to have reached the spore stage in bees.

Braula coeca, as in previous years, was found not to carry spores of *Nosema.*

Earwigs also did not appear to act as carriers, in so far as those examined by us did not contain spores.

Wasps.—A few wasps were examined. Some were obtained dead from hives, others were caught when robbing hives and when carrying away dead bees for food for their larvæ. One wasp, taken dead from a hive, had been very recently killed. Young meronts occurred in its gut walls. The other dead wasps did not contain spores, and had been too long dead for identification of young stages of *Nosema apis.* Robbers contained honey but no spores. Some of the wasps that frequented the alighting board of a hive where a number of bees which had died from *Nosema* occurred, were examined. In two cases they contained spores, whilst in most

cases young stages of the parasite occurred in their gut walls. Some of the wasp larvæ fed on the dead bees also had meronts in their food canals. We think that the wasps had contracted the disease from the bees, and the results are in agreement with those obtained experimentally (Supplement No. 8, p. 130), when a wasp colony died out as the result of supplying it with some infected dead bees.

Lesser Wax Moth.—Seven specimens of the lesser wax moth, *Achroea grisella*, L., were examined by us, but in two only were a very few *Nosema* spores found. The moths were dead when received, and so no evidence as to young stages of *Nosema* could be obtained.

Ants, wasps, and lesser wax moths, then, appear to be incriminated in the spread of *Nosema apis* during the season 1912–13. As the greater wax moth, *Galleria melonella,* has been found to contain *Nosema* spores on previous occasions, both wax moths may be regarded as occasional distributors of *Nosema* spores.

(*e*) SOME OBSERVATIONS ON PREVENTIVE MEASURES.

(1) *Lime.*—A few experiments made by treating spores with quicklime showed that lime caused shrinkage of the spores. Later, a case came to our notice in which an owner refused to destroy bees reputed to be infecting the neighbourhood. He was advised to use lime freely around the hive, and, if possible, to dust the bees with it. This was done, and it was stated that no more deaths occurred. It is impossible to say whether this was directly due to the lime, but the use of lime is worthy of trial.

(2) *Borax* and *Salicylic Acid.*—The effects of these substances on spores were tried by us with negative results. They were used by some bee-keepers, but the bees showed no improvement. Dusting the bees with these substances and mixing them in the food were both tried, but apparently with negative results.

(3) *Drainage.*—One or two districts known to us had shown much "Isle of Wight" disease, both last year and in previous years. In one case an ornamental urn in which *Nosema* spores had been found by us previously was removed, and a small dip in the grounds that frequently contained

stagnant water was filled in with sand and gravel at the end of 1911. The ground around the hives was limed thoroughly, and all the hives were blazed over with a painter's lamp. Restocking took place in the spring of 1912, and up to the time of writing there have been no signs of *Nosema apis*, though samples of these bees have been examined monthly by us.

SECTION II.

G. S. GRAHAM-SMITH, M.D., AND G. W. BULLAMORE, F.R.M.S.

(*a*) EXPERIMENTAL INFECTION WITH *Nosema apis*.

A considerable number of experiments have been carried out both on small and large lots of bees for the purpose of verifying last year's work. Experiments which merely confirm previous observations have not been quoted, only those which seem to throw some new light on the disease being mentioned.

(i) *Experiments on Small Lots of Bees.*—Maassen and Nithack (1910) apparently satisfied themselves that a large proportion of stocks in Bavaria is infected with *Nosema* without showing signs of the trouble. They stated that by keeping bees in confinement at a temperature of 14°—16° C. the latent *Nosema* developed (Supplement No. 8, p. 109). We attempted in the following experiments to ascertain whether such conditions prevail in this country. For this purpose a number of boxes were made (5 in. by 5 in. by 5 in. internal measurement) with two opposite sides of glass so arranged as to be capable of sliding in grooves, thus admitting of ready access to the interior. The other two sides contained ventilation holes covered with wire gauze, and in each box a section of honey was fixed. The boxes were then stocked with varying quantities of healthy bees. Some were kept in a darkened portion of the room, some in a cool incubator at 16° C. (61° F.), and others at 30° C. (86° F.) in an incubator with a moist atmosphere. In no case did we succeed in finding either spores or young forms of *Nosema* in these bees, although some of them lived under these conditions for two months. We are there-

fore of opinion that latent *Nosema* infection is not generally common in this country.

Last year we showed that *Nosema* spores present in the bodies of bees which had been dead four months were still infective. We carried out several experiments with these spores during the summer of 1912, but found that they were no longer capable of causing infection. Possibly this was due to the exceptionally dry summer of 1911. The bearing of these experiments is discussed on p. 26.

Mr. H. M. Cooper, of Thorley, Isle of Wight, having decided that he would not attempt to winter a number of doubtful stocks, kindly placed the bees at our disposal, and twelve lots with their queens were received by us, each lot containing from 200 to 1,000 bees. These lots were placed in glazed experimental boxes and kept in the incubators at 16° C. and 30° C.

The results obtained are shown briefly in the following table.

No.	Date received	Temp. of Incubator.	Date by which heavy loss occurred	Condition at end of experiment.	Result of examinations.	
					Young forms.	Spores
1	22 Oct	30° C	31 Oct.	3 Nov (all dead)	+	-
2	22 ,,	30° C	13 Nov	19 ,, ,, ,,	+	−
3	22 ,,	30° C	12–13 Nov	21 ,, (10 bees alive)	+	−
4	22 ,,	30° C	31 Oct (all dead)	—	+	−
5	23 ,,	30° C	15 Nov.	19 ,, (2 bees alive).	+	−
6	23 ,,	30° C	9 ,,	12 ,, (all dead)	+	−
7	26 ,,	16° C	8 ,, (all dead)	—	-	−
8	30 ,,	16° C	13 ,, (all dead except queen)	—	+	+
9	30 ,,	30° C	19 ,,	26 ,, (queen dead, 3 bees alive)	+	
10	9 Nov.	30° C.	19 ,, (queen and 1 bee alive)	—	+	−
11	9 ,,	16° C	14 ,,	25 ,, (queen and 4 bees alive)	+	+
12	9 ,,	16° C	14 ,, (all dead)	—	+	−

For several days nothing abnormal was noticed, a few bees dying daily. Then about certain dates (for instance November 13th and 19th) the majority of the bees in certain boxes were found lying at the bottom, many of them dead, and others with only sufficient strength to move their legs.

Very soon these latter also died. Before death a small percentage of the bees voided dysenteric fæces. After this heavy loss the remaining bees usually died within a week.

Possibly this indicates that a large proportion of the bees were infected at the same time by water or by other means, and consequently died off round a given date. Under natural conditions a very heavy mortality is often noticed on certain days, and possibly this phenomenon and the sudden deaths of whole stocks in the winter are due mainly to the same cause.

During the summer and autumn an opportunity occurred of watching the progress of the disease in an apiary under natural conditions. A large number of the stocks had perished in the spring, showing crawling symptoms. Although the symptoms ceased for a time in the summer, dwindling probably continued, for the robbing by wasps showed that several hives had become too weak to defend themselves. During this period anyone unacquainted with the previous history of the apiary would have considered the bees quite healthy. While crawling was in abeyance four stocks were transferred to hives which had been treated with Ayles' Isle of Wight cure. In the autumn the disease again made itself evident, and these four stocks, together with several others, rapidly died out. In November only three stocks were living, but these were found dead in January. In each case most of the bees had fallen to the floorboard, while the residue with the queen had died clinging to the combs.

A comb of sealed brood from a moribund colony in this apiary was placed in a wire cloth cage and brought into the laboratory. Here it was placed in an incubator at 30° C., and in a few days the bees hatched out. Some of these bees were transferred to one of the glazed experimental boxes and kept in the incubator at 30° C. Four days later bees were dying, and small intracellular bodies were found in them. On the ninth day numerous unmistakeable young forms of *Nosema* were seen in the chyle stomachs of some of these bees, which were then dying off rapidly. Infection may have been hereditary or pre-pupal; it may have occurred when the imago gnawed away the cell capping, or it may have occurred when it took stored food. Such points are difficult to deter-

mine, but the experiment demonstrates that it is not safe to assume that combs of brood and honey from dwindling hives will not cause infection.

Throughout the summer very few spore-containing bees were sent to us, but we expected that some spore-containing material suitable for infection experiments would come to hand From Dr. Burri we heard that the same dearth of spores was noticeable in Switzerland. Professor Zander, however, was able to supply us with spore-containing bees from Bavaria, and with these a series of infection experiments was carried out. In every case, however, we failed to find spores in the dying bees, although the presence of young forms could be demonstrated, apparently showing that the conditions were unfavourable for the production of spores.

We found that if crawling bees were placed in the incubator at 30° C. many recovered their power of flight. This was not a recovery of health, as some have suggested on analogous observations, for the bees died the next day, although returned to the incubator.

In another series of experiments some crawling black bees * were placed in a box with some healthy Italian bees, and the latter were examined from time to time. In one Italian bee only some doubtful young forms of *Nosema* were discovered.

From these experiments we think it doubtful whether infection is conveyed by bees infected with young forms only.

(ii) *Experiments on Hives of Bees.*—In 1912 we again attempted to carry out experiments with complete colonies in the house described in last year's report (Supplement No. 8, p. 87), but these were again unsatisfactory, although we attempted to make the conditions as favourable as possible. Walker (1875), in attempting to winter bees in a warm cellar, describes the same trouble, namely, that "many of the bees left their hives and clustered on the ceiling." This is the most serious difficulty we have met with in keeping bees in compartments admitting of cleansing flights, and appears to be fatal to experimental work of this kind.

A stock of bees suffering from the disease was received at the beginning of June, and was placed in a compartment. Several combs filled with honey were removed from this

* Dissections of control bees showed only young forms of *Nosema* and no spores.

stock, and a healthy natural swarm was placed on these combs in another compartment. The combs were alternated with frames containing starters of foundation, and on these the swarm clustered and manufactured comb. The mortality, though constant, was not excessive, and a small quantity of brood was reared. The increase was not sufficient to make up for the losses, and the swarm died out in five months. None of the bees examined from time to time showed the parasite, but since only a small proportion of the bees in the swarm could be examined microscopically, it is impossible to assert definitely that no cases of infection occurred.

A healthy Italian stock acting as a control swarmed out after a few weeks, and most of the bees were found dead in a corner of the compartment. A healthy stock of black bees in another compartment behaved in the same manner.

To another healthy Italian stock some "crawlers" (black) were added. The latter quickly died, but the Italians remained apparently unaffected, and the stock only died out after six months.

It was found that even in winter bees cannot be kept satisfactorily in such compartments.

Experiments with Fungi.—A bee caught flying in Kent, of which an illustration appears in the *Gardeners' Chronicle* (1882), was exhibited at a meeting of the Royal Horticultural Society in 1882, and was thought to be suffering from *Isaria* infection. Some of the fungi belonging to the genus *Isaria* are known to produce deadly disease in insects.

Through the courtesy of Mr. F. T. Brooks, of Emmanuel College, we were able to obtain a culture of *Isaria farinosa*, and decided to try its effect on bees. Experimentally it was found that this fungus killed caterpillars of the lackey moth (*Clisiocampa neustria*) in three to five days. The fungus grew through the skin and passed into the circulation, a tuft of hyphæ first appearing at the point of entrance. When caterpillars were fed with leaves contaminated with spores, they quickly died, and became covered with fungus hyphæ. Bees were fed on honey to which conidial spores of *Isaria* had been added. Death resulted in three days, but no external growth appeared. It is not unlikely that, in these cases, the death of the bees was due to poisoning.

(*b*) FURTHER OBSERVATIONS ON THE WAYS IN WHICH THE DISEASE MAY BE SPREAD.

Last year we discussed fully the various ways in which the disease might be spread. We have no evidence to indicate that we were mistaken in the views we put forward, and we do not therefore propose to consider again each method in detail, but merely wish to point out the bearing of certain facts which have come to our notice.

C. (1) *Interchange of Adult Bees* (Supplement No. 8, p. 104).—Further evidence of the interchange of bees in an apiary is given by Frank-Kleist. This observer "coloured the thorax of some 80 bees. He found them scattered all over the apiary, only a few remaining at their own home. More than that, a neighbour found two of the marked bees making themselves at home in his apiary an eighth of a mile distant" (Miller, 1912).

C. (4) *Occupation of Old Hives* (Supplement No. 8, p. 107).—Experiments already quoted (p. 22) show that spores which have been dried for some time lose their capability of infecting fresh bees. The spores on the combs and the walls of a hive, even when protected by a coating of fæcal matter, are much less favourably situated to withstand drying than those in the body of a dead bee. It follows, therefore, that a hive which has been occupied by a diseased stock may become a safe receptacle for bees after sufficient desiccation of the spores has taken place owing to dry weather or lapse of time. While some bee-keepers assert that infection has occurred from old hives, others are equally confident that this does not take place. The infectivity of a hive may not last long, since it depends on the vitality of the spores, which is influenced by atmospheric conditions and warmth. Also, in many cases the majority of the inmates may die before the spore stage is reached, and the hive in consequence may be non-infectious. The factors are so complex that it is difficult to decide without very elaborate microscopic examinations whether a recently tenanted hive is infectious. Possibly the varying experiences of bee-keepers may be explained by these facts.

D. "*Parasite Carriers*" (Supplement No. 8, p. 108).—We had no opportunity of making investigations on a sufficiently extensive scale to determine the exact importance of "parasite carriers" in certain outbreaks. The proportion of "carriers" present in any stock could only be ascertained by careful microscopic examination of large numbers of bees, and this we have been unable to carry out. In some cases which have been brought to our notice, "parasite carriers" seem to have played an important part, but in these cases it has been impossible totally to exclude other modes of infection.

E. *Infection by Human Agency* (Supplement No. 8, p. 111).—*Trade in Bees*.—Several outbreaks seem to have originated with bees obtained from the vendors in an apparently healthy condition. Pearman (1912) speaks of a case of Isle of Wight disease in Derbyshire, "a lady's only stock, which has been destroyed. I asked her where she got the bees, and found that they came from the same dealer as my Lincoln friend. I ought to mention that as a result of my Lincoln friend obtaining the swarm from this dealer, 'Isle of Wight' disease appeared in his apiary, destroying twelve stocks, and now seven other apiaries in the neighbourhood are affected. These dealers advertise for swarms, buy, and send them to all parts, and thus spread the disease."

Several instances of the same kind have been brought to our notice privately.

Use of Frames from Infected Hives.—Frames containing honey and brood are taken occasionally from dwindling hives and placed with healthy bees. It has been shown in these reports that spores can sometimes be found both in honey and on the frames, and we have given an experiment (p. 23) in which infected bees were obtained by artificial incubation at 30° C. from a comb of a brood taken from an infected hive. There can be no doubt, therefore, that infection may result occasionally from this practice. It should be noted, however, that symptoms may not appear for a long time, as crawling, on which the diagnosis is usually made, depends on a number of factors.

Comb Foundation.—Fantham and Porter record the finding of spores of *Nosema* in wax manufactured into foundation for use in bee-hives. We do not think, however, that infected

foundation has had much to do with the spread of the present epidemic. Most of the outbreaks are traceable to other cases of disease in the neighbourhood, or to the importation of bees from infected districts. In the initial rendering of the wax by the bee-keeper many of the micro-organisms must be carried down to the bottom of the cake of wax with the pollen, &c. Before being made up into foundation, it is re-melted and kept liquid for many hours,* and is often treated with acid to restore its colour. These manipulations must render foundation reasonably safe. So far as is known, attempts to induce foul brood by the use of foundation made from the wax of diseased hives have proved unsuccessful.

F. *Spread Within Small Districts* (Supplement No. 8, p. 113).—Last year Miss A. D. Betts, who had carefully studied the progress of the disease in a small district, supplied us with notes and a map which were published in last year's report (p. 114). Miss Betts has continued her investigation, and has supplied us with further maps and notes, which show that, since her last report, of the fifteen apparently healthy apiaries then recorded, four have been removed from the district, ten have contracted the disease, and only one remains apparently healthy.

These and many other observations show that under natural conditions the disease progresses somewhat slowly, about one to two miles per annum, even in heavily-stocked districts. No doubt the advance is often attributable to human agency, but under purely natural conditions the interchange of bees (p. 26) is probably the chief means of spread within a district.

G. *Influence of Climatic Conditions* (Supplement No. 8, p. 116).—The years 1911 and 1912, during which these investigations have been carried on, were totally different in character. Whereas 1911 was an exceptionally hot and dry year, 1912, except in the spring, was one of the coldest and wettest recorded. In these two years the disease has manifested itself in different ways. In 1911 spores were commonly found in diseased bees in the spring and early summer and in the winter, but were only found in 17 per cent. of the bees

* The melting point of the purest beeswax is about 145° F.

examined in the late summer and autumn. We stated that we thought that infection was mainly due to water contaminated with spores, and further that the water was mainly contaminated by "infected carriers" taking cleansing flights in the spring. In 1912 the spring was very dry, and the disease was little in evidence. This, we think, was due to the fact that though carriers infected the ground during cleansing flights, the lack of surface moisture gave few opportunities for healthy bees to infect themselves, and consequently the stocks to which they belonged. With the setting in of the wet weather towards the end of May the disease again manifested itself, and has been in evidence ever since. Moreover, many stocks which appeared to be healthy when packed down for the winter have since been found dead in their hives. We think that death during the winter is most likely to take place when heavy infection occurs at the time of the autumn brood-raising.

Fine weather may render the symptoms less apparent by increasing the vigour of the bees, while nectar, which is gathered at such times, probably acts much in the same way as feeding with syrup (p. 31).

(c) FURTHER OBSERVATIONS ON TREATMENT AND PREVENTION.

The pébrine of silkworms is a microsporidiosis caused by *Nosema bombycis*, an organism closely allied to *Nosema apis*. The medication of the mulberry leaves which constitute the food of the silkworms is easily carried out, and the poisonous nature of the drug need only be considered in relation to its effects on the silkworm. Syrup fed to bees is known to find its way at times into the supers, and therefore any drugs which it contains may also pass into them. Notwithstanding the advantages which this fact gives to the silkworm-breeder as compared with the bee-keeper, in the treatment of his stock, twenty years of experimentation failed to discover a drug cure for pébrine. The method which saved the silkworm industry was the destruction of the diseased insects and reproduction from healthy moths. (See Appendix.)

Since expressing the opinion in last year's report (Supplement No. 8, p. 125) that drugs are not likely to prove of value

in the treatment of microsporidiosis in bees, we have investigated the evidence put forward as to the value of drugs in the treatment of this disease.

The drug which can be used successfully and safely in the treatment of microsporidiosis must be one that injures the parasite but not the bee, is entirely innocuous to mankind, and affects neither the flavour nor the appearance of honey. These conditions must be fulfilled in the treatment by drugs of any parasitic disease of bees. Moreover, if bacteria, and not protozoa, are concerned in any way in the production of the symptoms, the task of ridding the bee of them is almost equally difficult. Experience has shown how common and how dangerous are typhoid carriers among mankind, yet no means have been found of ridding them of their bacilli.

Instead of feeding medicated syrup, substances are sometimes used which give off fumes at the temperature of the hive. A serious objection to this method is that there is no uniformity in the quantity administered. A strong stock rapidly evaporates such a substance; in a weak colony it disappears much more slowly. The temperature of the individual colony may range from 65° F. or less to over 100° F., and these variations will cause corresponding fluctuations in the evaporation of the chemical. It is possible that the fumes may have some slight inhibitory action on the growth of free bacteria in the hive, but fumes which are able to exercise a powerful effect on bacteria must be obnoxious to bees, and will either kill them or drive them from the hive. As soon as a pathogenic organism gains entrance to the tissues of a bee or a bee larva, any inhibitory action probably ceases, for even supposing that the drug can penetrate into the tissues of a bee through the tracheæ, its constitution is likely to be entirely altered.

Even in the case of foul brood—a disease said to be of bacterial origin (though the evidence is extremely conflicting)—the opinions as to the efficacy of drug treatment vary widely. While many believe that some of the advertised "specifics" are of use, some experienced workers during the last forty years have put on record their lack of confidence in drugs. Preuss (1868) held that medication in the treatment of foul brood was quackery, and Gates (1910) says: "Various

drug treatments have been recommended for spraying, feeding, and fumigation, but bee-keepers are urged to regard these as absolutely worthless in combating brood diseases, as has been proved by experiment."

There are two modes of treatment which usually effect a temporary improvement in a stock which exhibits crawling symptoms: (*a*) the administration of dilute honey or sugar syrup for prolonged periods; (*b*) the limitation of brood-rearing.

(*a*) *Cures due to Sugar Syrup.*—Sugar syrup is known to act as a purgative. If open-air feeding is practised the bees may be seen discharging drops of clear fluid as they fly back to the hives from the feeding pans. When syrup is given in the hive great activity prevails, and many bees may be seen taking cleansing flights. There can be no doubt that this process eliminates from the bowel large numbers of bacteria and their products, and also any of the *Nosema* parasites which may happen to be free. Possibly, also, *Nosema* toxins, of which, however, we have little knowledge, may be got rid of. Treatment by feeding undoubtedly effects temporary improvement, but no examples of a permanent cure have come to our knowledge.

Reid (1911) prolonged the life of some bees by feeding with dilute honey to which Bulgarian sour milk had been added. There was no evidence that the bacillus of sour milk had multiplied in the stomachs or intestines of the bees so treated, and when feeding ceased they died. It is probable, therefore, that the dilute honey was the cause of the improvement.

(*b*) *The Limitation of Brood as a Cure.*—It is well known that broodless and queenless bees live much longer than the bees of a normal stock, but that they quickly wear out if brood is given to them to rear. The secretion of brood-food is apparently very exhausting, and when relieved of this drain on them the bees in a diseased hive often cease to manifest the crawling symptoms after a few days. This association of crawling with brood-rearing perhaps explains why the stock which is the only survivor in a smitten apiary is often found to be queenless. It explains also why the strongest stock is the first to show the symptoms in spring, and why the swarm,

headed by a fertile queen, usually shows the disease a few days before the parent stock.

Simpson (1910) and others attempted to cure the disease by sprinkling sulphur over the bees and combs, and at first it was thought that a specific had been discovered. This operation kills the unsealed brood, unless it is removed prior to treatment. Any drug which is fatal to the brood, such as sulphate of iron, will also effect a temporary improvement if administered.

In April, 1912, a cure based on a new theory of the cause of the disease was put forward. Ayles (1912) says:—"In examining my most affected colonies I found a fungoid growth so fine in its character that with the naked eye it was impossible to discern the dividing line between the affected and non-affected portions of the combs. On examining with a microscope I found that the fungus in spreading was of a filamentous nature, and when developed resembled minute mushrooms, leaving a fine mould as its residue full of spores closely allied in appearance to the spores of the Bacillus diphtheria."

None of the fungi described by Betts (1912) as occurring on the combs from stocks which had died of the "Isle of Wight" disease appear to resemble minute mushrooms, and no fungus was found by this observer which does not occur in healthy hives. The latter part of the description is not a happy one, since the diphtheria bacillus is not known to produce spores. Exceptional importance has been attached to the method recommended to combat this fungus. When used as a disinfectant, the remedy suggested has apparently been credited with even greater germicidal powers than the painter's blow-lamp, for we read: "In cases of foul brood scorching is all that is necessary, but where 'Isle of Wight' disease is present, the hive should be treated with Ayles' 'Isle of Wight' cure" (Herrod, 1912).

This remedy, which is a preparation resembling creosote, is applied to the inner walls and floorboard of a hive into which the bees are afterwards transferred. If the transference occurs too soon after the hive has been dressed, large quantities of unsealed brood are thrown out. When the transference is made a few days after treatment, a careful watch

will sometimes reveal an occasional worker carrying a minute larva out of the hive and flying off with it. This destruction of the larvæ may account for the temporary improvement sometimes noticed. In order to test this remedy, during the summer of 1912 four hives were dressed with the preparation and four stocks were transferred to them in an apiary where the disease was known to be present. These stocks and the surrounding ones in untreated hives died off with equal rapidity in the autumn.

Several statements referring to the failure of this remedy have been published. Muir (1912) writes: "We had our stocks treated with Ayles' cure, thinking it might act as a preventive, and treated them also with another remedy, but it was all labour in vain and lost cash; it had no effect." Macdonald (1912) expresses wholehearted agreement with Muir, and adds: "So-called cures were (with me) like the application of so much dirty water." Smith (1912) writes: "I transferred the bees at once into clean hives, previously dressed with Ayles' cure, but in spite of this they gradually dwindled and died." Testimonials given to this and other remedies during the fine spring of 1912 should be accepted with reserve. No example of an undoubted *permanent* cure has come to our notice, but numerous complaints of the continuance of the disease after the use of the cure have reached us.

Ayles' cure appears to be a powerful germicide and wood-preservative, and its fumes probably restrain to some extent the growth of fungi. We have not observed Mr. Ayles' fungus, and in consequence have not been able to test the action of his cure upon it. Its value, however, in microsporidiosis appears to us to be without satisfactory proof.

A. A. B. (1912) tells of the benefit noticed after the use of some secret remedy. After the third treatment dead or dying pupæ were being dragged from the hive. The death of the brood would account for the improvement in the adults.

It seems likely that the magnitude of the present epidemic is mainly due to the trade in bees which has followed the development of the bee-industry. The disease is now so widespread that complete cessation of the trade in bees for a time is the only measure likely to be of any avail. This would interfere but little with the genuine business of bee-keeping,

viz., the production of honey. No doubt many stocks would die while in the possession of their present owners, but healthy apiaries would escape and could be multiplied later.

In several instances healthy stocks removed from an infected apiary to fresh ground have escaped the disease. Such a measure promptly carried out might be sometimes efficacious.

SECTION III.

W. Malden, M.D.

Bacteriology of the Disease.

Continued bacteriological investigations have failed to reveal any species of bacteria constantly associated with the symptoms of the Isle of Wight disease, and experiments have shown that *B. pestiformis apis*, in pure culture, is not pathogenic to bees. As shown last year (Supplement No. 8, p. 133), bacteria are more numerous in the chyle stomachs of bees suffering from *Nosema* than in those of healthy bees, and bacteria are certainly numerous in the chyle stomachs of bees kept in confinement. No doubt the species vary under different conditions, but I am of opinion that the toxins produced by them play no inconsiderable part in producing the symptoms of the disease under natural conditions and in killing off bees in confinement.

It must be remembered that crawling, the symptom on which the Isle of Wight disease is so often diagnosed, is merely a sign of weakness from parasitic intoxication or other causes, and may possibly at times be due to a specific bacterial infection.

SECTION IV.

Summary of Investigations on the Isle of Wight Bee Disease.

History.—The study of the records relating to the diseases of adult bees has shown that several outbreaks closely resembling the epidemic under investigation have been described at various times in this country, and in other parts of the world during the last two centuries. It is almost certain, therefore, that the disease is not a new one. Attention was first called to the present outbreak by bee-keepers in the Isle of Wight in 1906, but the records show that it was already present on the mainland, though the losses were attributed to other causes. At the present time no part of Great Britain appears to be free from it (Supplement No. 8, Sec. II., pp. 12–28).

Symptoms.—Certain symptoms, such as the inability of some of the diseased bees to fly, the presence of numerous bees on the ground in front of the hives, and the gradual dwindling of stocks are common, but many other symptoms have been recorded, and no one symptom is characteristic of the disease. The only essential feature is the death of large numbers of bees, and often of the whole stock, especially during wet and cold periods of the year or during the winter months. It has been further shown that the disease is probably endemic, but that owing to lack of observation it often passes unnoticed in mild seasons, the loss of the bees being attributed to cold, starvation, spring dwindling, robbing, wax moth, diarrhœa, and other causes. It is only during severe epidemics that the disease attracts much notice. These epidemics are especially apt to make their appearance during cycles of wet and cold springs and summers, but

continue subsequently for some seasons (Supplement No. 8, Sec. III., pp. 29–38).

Relation of Nosema apis *to the Disease.*—During the years 1911 and 1912 *Nosema apis,* in some stage, has been found in almost every stock apparently suffering from the Isle of Wight disease which has been examined, and, moreover, no bacteria other than those found in normal bees have been detected. It can therefore be stated with confidence that *Nosema apis* is the agent responsible for most of the outbreaks in which the symptoms of the Isle of Wight disease have been noticed or in which stocks have dwindled or died without apparent cause.

Life History.—Infection of the bee is usually brought about by the ingestion of the spore, and consequently the life history may be traced from the spore stage. Within the chyle stomach the spore wall is softened by the action of the digestive juice of the bee which penetrates to the spore contents. Stimulated by the juice, the polar filament of the spore is forcibly ejected, and serves for a short time as an organ of attachment, fixing the spore to the gut-wall. From the spore an amœbula emerges, creeps about over the intestinal surface, and by division daughter amœbulæ may be produced. Usually the amœbulæ penetrate the cells of the gut, but occasionally may pass into the hæmocœlic fluid. Within the cells of the gut wall the amœbulæ become rounded, and, after a period of growth, division occurs, resulting in the production of meronts. These meronts ultimately give rise to spores, which are shed into the intestinal canal and voided with the fæces (Supplement No. 8, Sec. V., pp. 37–78, and plates II, III, and IV).

The parasite is usually restricted to the alimentary tract of the adult bee, but has been found also in the hæmocœlic fluid, though not in the salivary or wax glands, and only doubtfully in the ovaries, testes, or genital tract. Infected larvæ and pupæ have occasionally been met with.

Experimental Infection.—Since no method of cultivating *Nosema apis* outside the body of the bee has yet been devised, spores of *Nosema,* obtained from the bodies of diseased bees, were used for infection experiments. It has been shown that the disease can be produced in healthy bees by feeding with

syrup or honey containing spores, by contaminating their food with infected excrement, by allowing them to feed on candy previously used by infected bees, by placing bees which have died from the disease in the cages occupied by healthy bees, and by confining healthy bees in cages in which diseased bees have travelled. Some of the experiments seemed to indicate that partially immune stocks exist, which can only be caused to suffer from the disease with difficulty, but which may harbour the parasite and act as centres of infection for susceptible stocks (Supplement No. 8, Sec. VI., pp. 79–94). It should be noted that the spore stage alone appears to be capable of giving rise to infection.

Modes of Spread.—Many possible modes of spread exist which have been very fully considered, but only a few appear to be of great practical importance.

(*a*) *Infection by the Agency of Food Materials taken into the Hive.*—Water or moisture near hives contaminated with infected excrement appears to be the most important factor in the dissemination of the disease; nectar, pollen, or other substances collected as food may on rare occasions be infected.

(*b*) *Infection within the hive* may occur through infected water stored in the cells, the passage of wax, &c., from bee to bee, and more especially by excrement deposited by infected queens, drones, and worker bees suffering from dysentery. Pollen and honey contaminated by excrement may also cause infection.

(*c*) *Infection from hive to hive* and from apiary to apiary is brought about mainly by the interchange of adult infected "carriers," and to a less extent by robbing, especially when the living remnants of the weak stock join the robbers, by infected swarms entering healthy apiaries, and by the occupation of old hives.

(*d*) *Infected "carriers"* are probably most important agents in spreading the disease by infecting water or food with their fæces, as well as in keeping it in existence from season to season.

(*e*) *The trade in bees* from infected districts helps to disseminate the disease over greater areas than would be reached by natural means.

(*f*) *Cold and wet weather*, by affecting the healthiness of stocks and affording opportunities for bees to gather contaminated moisture near hives, greatly influences the spread of the disease.

(*g*) *Other insects* associated with hives of bees, such as wax-moths, wasps, and ants, and other species of bees, may at times carry the spores, and thus play some part in their dissemination (Supplement No. 8, Secs. VII., VIII., IX., and XI., pp. 95–124, 130–132).

Treatment and Prevention.—There is little evidence that treatment by any of the remedies which have been suggested results in permanent cure, though amelioration of the symptoms for a time not infrequently occurs. Prevention is therefore the only satisfactory method of controlling the disease. Healthy stocks should be removed from the neighbourhood of diseased ones, and the bees should be supplied with an easily accessible supply of *clean water*, which should be changed daily, and protected from contamination by flying bees. If necessary, the usual drinking places should be removed. Bees which have died of the disease, frames, quilts, &c., from infected hives should be burnt, and the hives should be disinfected, preferably by slight charring. The *ground* should be turned over and treated with lime. *Diseased stocks* should be destroyed as soon as the condition is diagnosed, and, further, healthy bees should not be introduced into an apiary where the disease has shown itself. Driven bees and stocks from infected districts should not be imported into other districts. Finally, an endeavour should be made to build up apiaries from stocks which have escaped infection (Supplement No. 8, Sec. X., pp. 125–129).

Bacteriology.—No species of bacteria constantly associated with the Isle of Wight disease has been found, and *B. pestiformis apis*, which is frequently present in diseased stocks, and was at one time thought to be the causal agent, is not pathogenic in pure culture. Bacteria, however, may play an important secondary part in producing the symptoms when the resisting powers have been lowered by the action of *Nosema* (Supplement No. 8, Sec. XII., pp. 133–137).

APPENDIX.

A Short Account of Pasteur's Investigations on the *Nosema* Disease of Silk-worms, known as Pébrine.

"The production of silk forms the principal industry of several departments in the South of France, and the rearing of silk-worms occupies the time and attention of great numbers of people. Previous to 1849, this industry had been particularly flourishing; but in that year, after an exceptionally good silk-harvest, and without any appreciable cause, several of the large establishments were visited by disease among the worms, and this in the course of time assumed the proportions of a plague among the silkworm-nurseries, until at last the silk-husbandry of France was on the verge of ruin. The symptoms of the disease were numerous and variable; sometimes the worms died early, at other times not before the first, second, or third moulting; oftentimes the eggs were sterile. Instead of becoming white, the worms retained a rusty tint; they did not eat; spots appeared on their bodies like black bruises, which were scattered over the head, rings, and feet. Every batch of brood attacked perished. Fresh eggs were imported from abroad, and at first these hatched well—so much so that the year 1853, when a large quantity of these foreign worms was reared, was estimated as one of the most productive of the century, 130,000,000 francs being derived as revenue from the cocoons. But in the following year the eggs from these worms were found to be no better than the French eggs—they were also infected. To add to the misfortune, the malady extended to Spain and Italy, then to Greece and Turkey, until, in 1864, all the cultivations from every part of Europe were either diseased or suspected of being so; and, throughout the extreme East, Japan only was

exempt. The plague had followed the trade in silkworm eggs, in the same way that cattle diseases have followed the trade in cattle.

"In 1865 the weight of cocoons had fallen so low that the French revenue sustained a loss of 100,000,000 francs, and the silk-cultivating departments were in despair. Agricultural and scientific societies, municipal bodies and governments were all seriously engaged in attempting to discover the cause and a remedy. There was no lack of hypotheses, suggestions, and cures; while scores of pamphlets upon the malady were published every year, and experiments were undertaken to elucidate the mysterious scourge, and limit its ravages.

"The disease was known as 'pébrine' owing to the peppered appearance of the skin of diseased worms" (Fleming, 1886).

In 1865, in response to a petition signed by 3,600 mayors, municipal councillors, and capitalists of the severely-visited departments, the French Government appointed a Commission to investigate the malady, and Dumas was selected as its chairman because of his great scientific reputation and his personal interest in one of the afflicted departments. It occurred to him that Pasteur was the man best fitted to carry out investigations as to the measures required to combat the plague. Pasteur at first declined the heavy task, but at length was persuaded to undertake it.

Among the hypotheses and observations relating to pébrine that had been accumulating for seventeen years was an interesting memoir by M. Quatrefages (1860). This memoir disposed of the view held by many of the peasantry that the disease was due to a change in the mulberry leaf which had rendered it poisonous to the silkworm. But a paragraph in it which particularly struck Pasteur had reference to the discovery by some Italian naturalists of microscopical bodies—vibratory corpuscles—in the silkworms and moths, which Lebert affirmed could always be detected in diseased specimens, and which Osimo, of Padua, had also perceived in silkworms' eggs. Another Italian, Vittadini, had even proposed the examination of the eggs by means of the microscope, in order to exclude infected samples.

"On June 6th, 1865, Pasteur started for Alais, where the

plague raged most disastrously, and within a few hours of his arrival he had proved the presence of corpuscles in certain worms, and shown them under the microscope to the president and several members of the Agricultural Society, who had never seen them before. Next day he was installed in a little house, where two small silkworm cultures were going on. One of these was produced from eggs imported that year from Japan, and was doing well. The other was from eggs originally Japanese, but reproduced in the country, and was less healthy. Now, strange to say, on examining microscopically the chrysalides and moths of the good group, he found corpuscles almost always present, whereas the matured worms of the bad group exhibited them only occasionally" (Priestley, 1891).

Pasteur soon arrived at the conclusion that it was a mistake to seek for the corpuscles in the worms or eggs. The mischief arose chiefly from eggs laid by "corpusculous" moths, and as a remedy he suggested that, after laying its batch of eggs, each moth should be pounded up and examined. If the microscope revealed the presence of corpuscles the eggs were to be burned, but if no corpuscles were found the eggs were to be considered healthy. Subsequent work showed that the disease was contagious, and could be produced by contamination of the mulberry leaves with the fæces and the crushed bodies of "corpusculous" larvæ, or by the dust from a "chamber" in which the disease had committed its ravages.

Occasionally a perfectly healthy batch of worms was produced in a nursery which had been badly smitten with disease the previous year. Pasteur proved that dust containing the germs of pébrine, when dried, rapidly lost the power of producing that malady. One interesting experiment showed that dust from a nursery which had been visited by both pébrine and flacherie (a disease associated with weak digestion) retained the power of producing flacherie after its capability of producing pébrine had ceased.

Pasteur's views were not readily accepted, many contending that corpuscles were normally present in all silkworms, and it was eventually necessary for him to give practical proofs of the truth of his theory by taking charge of a silkworm-breeding establishment that was hopelessly smitten

with the disease. This establishment, the property of the Prince Imperial, was situated near Trieste, and for ten years the silk-harvest had not sufficed to pay for the cost of eggs. Under Pasteur's management in a short time a net profit of twenty-six millions of francs was realised.

Prior to this, however, Pasteur had adduced some interesting facts in support of his theory. He quotes (1869) a communication to the *Moniteur des Soies,* stating that some eggs guaranteed as healthy by himself had produced no sick worms. Two samples of eggs were submitted to Pasteur by the Mayor of Callas, and were pronounced to be unfit for use. The breeders thought otherwise, and attempted to utilise the eggs, but with disastrous results. For example, one cultivator exhibited to the mayor a single cocoon which he stated was the sole product of twenty-five grammes (about 35,000 eggs) of one of the condemned samples.

A strain at Grenoble when examined in 1868 was found to be free from corpuscles. For five years this strain had produced a high yield of silk.

In a commune in the Rhone valley where the industry had so decayed that the mulberry leaves remained unpicked, a healthy strain was re-instituted by a rigid selection from 700 worms until only eight pairs of moths free from corpuscles were obtained. The offspring of these proved remunerative.

Pasteur also gives an account of an interesting condition at an isolated farm in the Basses Alpes. Excellent yields of silk were obtained from this strain of silkworms from 1862–1867, although the moths were found to contain a few corpuscles and to lay a small percentage of infected eggs. In 1868 this cultivation was ruined by flacherie, and Pasteur expresses the opinion that this, and other facts known to him, tend to demonstrate that pébrine, even when not fatal, predisposes to other diseases.

The corpuscles detected in the diseased silkworms were the spores of *Nosema bombycis,* an organism closely allied to *Nosema apis.* In the twenty years preceding the adoption of Pasteur's recommendations, innumerable remedies were tried. Some of these are discussed by Pasteur in his monograph on pébrine (1870). He could understand why numerous remedies should be advocated for a disease causing so much

economic loss, but what excited his surprise was the blind confidence with which they were in turn accepted. The solid remedies included flowers of sulphur scattered over the worms or the mulberry leaves, flowers of sulphur mixed with powdered charcoal, mustard flour, powdered Peruvian bark, gentian, valerian, mixtures of these substances in various proportions, ashes, camomile, soot, and sundry secret powders. The liquid remedies included wine, rum, absinthe, sulphuric acid, nitric acid, vinegar, lime water, natural sulphurous waters, and solutions of sulphate and lactate of iron. Fumigations with chlorine gas, with sulphurous acid vapour, with nitrous vapours, and with tar were also advocated. This is not an exhaustive list. Pasteur remarked in 1870 that notwithstanding the unsatisfactory results of medical treatment, new specifics were frequently announced. Fumigation with creosote was counselled so persistently and the consequent demand was so great that the drug increased in price. Pasteur found that infection experiments were as successful in a chamber impregnated with creosote vapour as under ordinary conditions. An agricultural society recommended that the sick worms should be dipped in a weak solution of nitrate of silver. Pasteur experimented, and found that the dipping accelerated the death of the worm. A larva containing corpuscles was then crushed in some of the nitrate of silver solution, and mulberry leaves were damped with the resultant liquid. All the healthy worms which ate these leaves became infected.

Pébrine was, at first, thought to have spread from a single focus in Vaucluse, but Quatrefages (1860) showed this view to be untenable. Districts were known to him where the culture of silkworms had only been possible for the past twenty years by the continued importation of eggs, locally raised eggs being unprofitable. More detailed information in regard to previous outbreaks is given by the Commission des Soies (1856), which conclusively shows that the disease, though regarded as a new one in the middle of the nineteenth century, was well known 150 years before. For several years previously the losses in the South of France were such that in 1692 all hope of arresting the progress of the disease was abandoned, and everywhere the mulberry trees were destroyed

as useless. Even in the sixteenth century outbreaks were recorded (Olivier de Serres). It is not improbable, therefore, that the disease was endemic in a number of districts, but failed to attract attention until the increase of the trade in silk-worm eggs gave rise to the epidemic. Pasteur (1870) remarks that in the fortunate epoch preceding the trouble, the loss of worms was attributed to inexperience or to neglect, and was something to be ashamed of. With the spread of pébrine we hear no more of bad cultivators, the malady accounting for all lossès.

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THE CORRELATION BETWEEN THE PERCENTAGE OF MILK FAT AND THE QUANTITY OF MILK PRODUCED BY AYRSHIRE COWS.

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SUPPLEMENTS TO THE JOURNAL OF THE BOARD OF AGRICULTURE.

CONTENTS

THE investigation described in this Supplement was undertaken by the Board owing to a desire for figures showing as definitely as possible the extent of the correlation between the quantity and the quality of milk yielded by a cow. The work of preparing a report on the subject was entrusted to Mr. H. D. Vigor, an Assistant to the Head of the Statistical Branch of the Board. It was thought desirable to include in the calculations such other variable factors as might affect the milk yield of the cow and the percentage of fat contained in the milk, and for this reason it was decided to deal also with the age of the cow, the duration of lactation, and the date of calving. The calculations are based on data given in a Report of the Ayrshire Cattle Milk Records Committee. The Board desire to thank Mr. John Howie, the Secretary and Treasurer of the Scottish Milk Records Society, for his kindness in supplying them with the data necessary for the investigation.

BOARD OF AGRICULTURE AND FISHERIES,
4, WHITEHALL PLACE,
LONDON, S W.

August, 1913.

THE CORRELATION BETWEEN THE PERCENTAGE OF MILK FAT AND THE QUANTITY OF MILK PRODUCED BY AYRSHIRE COWS.

(*An Analysis of Milk Records of the Ayrshire Cattle Milk Records Committee.*)

H. D. VIGOR, B.SC. (*Econ.*)

Introduction.

THE object of this paper is to present the results of an investigation into the relationship between the rate of milk production of cows and the percentage of milk fat in the milk produced. The material analysed was published in the Report of the Ayrshire Cattle Milk Records Committee for 1909. The milk records there published show, for each cow dealt with, so far as the information is available, the total milk yielded (in gallons), the average percentage of milk fat found at periodical tests, the duration of lactation (in weeks and days), the age of the cow (in years), the date of last calving, and the date of going dry. The farms providing returns are identified by letters, and the cows by numbers.

The number of cows dealt with in the Report was 9,202, belonging to 212 members of thirteen milk record societies. For only four societies, viz., Carrick, Central Ayrshire, Fenwick, and Lesmahagow, did the testing period extend over the whole of the year. For many cows in the Carrick and Central Ayrshire Societies the age was not given. In the Lesmahagow Society many cows had not completed lactation at the end of 1909. The records of the Fenwick Society were accordingly taken, as being the most complete, and it is to the records of this Society only that the analysis of the present

paper has been applied. In the Fenwick Society the number of cows tested was 966. For 586 of these cows which completed their lactation in 1909 complete records could be obtained. The cows were distributed over twenty-six farms in the Fenwick district. Some had calved in the spring of 1909, some in the autumn of 1908, some in the spring of 1908, and a very few in the autumn of 1907.

Tabulation of the Records.—The age of the cow and the length of the lactation period appeared to be factors which might possibly exert influences, independent of each other and of the amount of the milk yielded, upon the percentage of milk fat produced. The rate of milk production also seemed to be measured more accurately by the average quantity of milk yielded per week of the lactation period than by the total quantity for the lactation. The data for the 586 cows were therefore extracted with the object of determining the partial or net correlation between the four variable factors:—

1. Per cent. of milk fat.
2. Average weekly yield of milk.
3. Duration of lactation.
4. Age of cow.

The average weekly yield of milk was obtained by dividing the total yield by the number of weeks in milk. The other data are actually given in the Report, and consequently the records for each cow tabulated are not printed here.

The data were then placed on six correlation tables (*see* Appendices A to F), for each of the four variables taken two at a time, as follows:—

Appendix A.—(1) Per cent. of milk fat.
(4) Age of cow.
„ B.—(1) Per cent. of milk fat.
(2) Average weekly yield.
„ C.—(1) Per cent. of milk fat.
(3) Duration of lactation.
„ D.—(2) Average weekly yield.
(3) Duration of lactation.
„ E.—(3) Duration of lactation.
(4) Age of cow.
„ F.—(2) Average weekly yield.
(4) Age of cow.

Averages and Standard Deviations.—The averages were calculated from the actual records before being grouped into class frequencies for the correlation tables. The standard deviations were adjusted to these true averages. Sheppard's correction of the standard deviation for grouped frequencies was used for each variable, except for the ages, since the frequency curve of the ages did not give what is technically known as "high contact" at the lower frequencies. The averages of the ungrouped and grouped frequencies agreed in the third decimal place for the percentage of milk fat and duration of lactation, and differed only by 0·01 for the age and weekly yield of the cow. In order to obtain greater accuracy in the arithmetical work depending on the averages and standard deviations their values were calculated to four places of decimals.

Table 1.

	Average.	Standard Deviation.
1. Per cent. of milk fat	3·6811 per cent.	0·3229 per cent.
2 Weekly yield	16·8287 gallons	4 0704 gallons
3. Duration of lactation	38 1104 weeks	9 2552 weeks
4. Age of cow ...	5 6613 years	2 8389 years

Homogeneity of Material.—The statistics under analysis include records of cows calving at three principal periods, viz., January–June, 1908 (161 cows), July–December, 1908 (287 cows), January–June, 1909 (132 cows), a total of 580 cows out of the 586 tabulated. The predominance of cows calving in the autumn of 1908 is due to the fact that the records tabulated for 1909 include all cows which completed lactation in the latter year, and a large proportion of these would naturally be cows which calved in the second six months of 1908.

The grouping in one table of records for cows which calved at different seasons might be criticised as likely to make the records heterogeneous as regards the weekly yield of milk and the percentage of milk fat, owing to such causes as the weather, state of pastures, supply of water, and the difference between summer and winter feeding.

The following table shows the average of each of the four variable factors in each group of cows :—

Table 2.

Calving period.	Milk fat.	Average weekly yield.	Duration of Lactation.	Age of Cow.
	Per cent.	Gallons.	Weeks.	Years.
a. Jan to June, 1908	3 69	16·61	43·9	6·7
b. July to Dec , 1908	3·69	16·99	37·7	5·1
c. Jan. to June, 1909	3·64	16·77	33·0	5·9

These averages exhibit differences as between the groups of cows, but each difference should be tested by the probable error of the difference in order to determine whether it should be considered as arising from causes other than the errors of random sampling.*

The differences between the group averages of Table 2 and the probable errors of those differences are tabulated in the next table, in which the differences are stated irrespective of sign.

Table 3.

	Milk Fat.	Average Weekly Yield	Duration of Lactation.	Age of Cow.
	Per cent.	Gallons.	Weeks.	Years
$a \sim b$	0·00	0 38±0·27	6·2±0·61	1 6±0 18
$b \sim c$	0·05±0·02	0 22±0 29	4 7±0·65	0 8±0·19
$a \sim c$	0·05±0·025	0·16±0·33	10 9±0 73	0·8±0 22

For a difference to be significant, *i.e.*, for it to be considered as very probably due to some other cause than random sampling, it should be of a magnitude about five times greater than its probable error.

* The probable error of a difference is given by the following formula

$$E_{a-b} = \pm 0{\cdot}67449 \sqrt{\sigma^2\left(\frac{1}{n_a} + \frac{1}{n_b}\right)},$$

where

σ = standard deviation of the particular variable (*e.g.*, weekly yield) for the whole number of cows tabulated ;

n_a = number of cows in group a ;

a, b refer to calving periods specified in Table 2

Table 3 shows that the differences of the average weekly yield of milk and average percentage of milk fat as between the three groups of cows cannot be regarded as significant when their probable errors are taken into consideration. The differences of the average lactation periods are undoubtedly significant and must be regarded as due primarily to the fact that cows which calved in the spring of 1908 or autumn of 1908 and completed lactation in 1909 must of necessity show a longer average lactation than cows which calved in the spring of 1909 and completed lactation in the same year. The difference in the length of the lactation period would not appear, however, to have influenced appreciably the average weekly yield or average percentage of milk fat given, and this fact will be brought out later by the more definite evidence of the partial correlation coefficients.

The difference between the ages of the cows calving in the first and second six months of 1908, respectively, is too great to be attributed to errors of random sampling. So far as the evidence of Tables 2 and 3 goes, however, the difference does not appear to have caused significant differences in the average weekly yield of milk and the average percentage of milk fat.

Thus it may fairly be concluded that the selection and tabulation in one table of records of cows calving in the spring of 1908, autumn of 1908, and spring of 1909, respectively, does not affect the homogeneity of the combined record as regards the weekly yield of milk and the average percentage of milk fat, from causes such as conditions of feeding, weather, water supply, and other factors. The groups are diverse to some extent as regards age constitution, and to a great extent as regards the length of lactation; the influence, if any, of these differences upon the weekly yield and the percentage of fat remains, however, to be directly ascertained by the method of correlation.

The conclusion thus arrived at, that the season of calving did not sensibly affect the rate of production and quality of the milk produced contrasts with the conclusion drawn from the results of records collected by the Agricultural Department of the University of Leeds, and published in a Bulletin (No. 84, Variation in the Composition of Cows' Milk with Advance of Lactation, 1912). It was there found that on the average of

the whole period the calvings that fell in the months December to February proved the most profitable in milk yield (average 22·2 lb. per day), and April calvings the least profitable (16 0 lb.). "These facts are not put forward as new discoveries, but they may serve to point the moral as to the influence of the time of calving upon the rate of shrinkage in milk production."

But these conclusions are based upon records of nine cows calving in December, January and February, seventeen cows calving in March, thirteen in April, eight in May, June and July, and nine in August, September, October and November. It would seem, however, that averages based on such small numbers must be liable to very large errors of sampling. This is, indeed, recognised later on.

In a paragraph on "Variation in Percentage of Fat," after recording differences in the percentages in thirteen cows calving in October to February, seventeen cows in March, thirteen in April, and fourteen in May to September, the Bulletin states that: "It is doubtful, however, whether the number of lactations investigated is sufficient to warrant these conclusions being accepted as generalisations."

As a further test of the conclusions on this subject, given above, the records have been analysed in the manner shown below.

Influence of Time of Calving upon Quantity and Quality of Milk Yield.

(1) *Influence upon Quantity of Yield.*—The relationship between the weekly yield of milk and the date of calving may be tested approximately by forming 2 × 2 fold tables with the following characters:—

Table 4.—(*a*) Yield over 17 gallons per week.
„ under „ „ „
(*b*) Calving January–June, 1908.
„ July–December, 1908.

Table 5.—(*a*) Yields as in Table 4.
(*b*) Calving July–December, 1908.
„ January–June, 1909.

Table 6.—(*a*) Yields as in Table 4.
(*b*) Calving January–June, 1908.
" " 1909.

The frequencies of the respective characters are given in the following tables, followed by the *coefficients* of *colligation*, and their probable errors, calculated as explained in Mr. G. U. Yule's paper "On the Methods of Measuring Association between Two Attributes" (*Journal of the Royal Statistical Society*, May, 1912). The *coefficient of colligation* forms a measure of the relationship between the variables tested.

Table 4.

	Weekly Yield.		Total.
	Over 17 Gallons.	Under 17 Gallons	
Calving January—June, 1908	52	80	132
Calving July—December, 1908	132	155	287
Total	184	235	419

The coefficient of colligation between yields under 17 gallons and calvings from July to December, 1908 = $-0{\cdot}067 \pm 0{\cdot}015$.

Table 5.

	Weekly Yield.		Total.
	Over 17 Gallons	Under 17 Gallons.	
Calving July—December, 1908	132	155	287
Calving January—June, 1909	72	89	161
Total	204	244	448

The coefficient of colligation between yields under 17 gallons and calvings in January–June, 1909 = $+0{\cdot}013 \pm 0{\cdot}032$.

*a** 2

Table 6.

		Weekly Yield.		Total.
		Over 17 Gallons.	Under 17 Gallons.	
Calving	January—June, 1908	52	80	132
	January—June, 1909	72	89	161
Total		124	169	293

The coefficient of colligation between yields under 17 gallons and calvings in January–June, 1909 = $-0{\cdot}0055 \pm 0{\cdot}039$. The three coefficients obtained show that no appreciable association exists between the period of calving and the weekly yield of milk.

(ii) *Influence upon Quality of Milk.*—For testing approximately this relationship 2×2 fold tables were formed for the following pairs of characters:—

Table 7.—(*a*) Percentage of milk fat, 3·68 and above.
„ „ under 3·68.
(*b*) Calving in January–June, 1908.
„ July–December, 1908.

Table 8.—(*a*) Percentage of milk fat as in Table 7.
(*b*) Calving in July–December, 1908.
„ January–June, 1909.

Table 9.—(*a*) Percentage of milk fat as in Table 7.
(*b*) Calving in January–June, 1908.
„ „ 1909.

Table 7.

		Percentage of Milk Fat.		Total.
		3·68 and above.	Under 3·68.	
Calving	January—June, 1908	70	62	132
	July—December, 1908	148	139	287
Total		218	201	419

The coefficient of colligation between milk fat, 3·68 per cent. and above, and calvings in July–December, 1908, = −0·0135 ± 0·033.

Table 8.

		Percentage of Milk Fat.		Total.
		3·68 and above.	Under 3·68.	
Calving	July—December, 1908 ..	148	139	287
	January—June, 1909 ..	70	91	161
Total		218	230	448

The coefficient of colligation between milk fat, 3·68 per cent. and above, and calvings in January–June, 1909 = −0·081 ± 0·032.

Table 9.

		Percentage of Milk Fat.		Total
		3·68 and above	Under 3·68.	
Calving	January—June, 1908	70	62	132
	January—June, 1909	70	91	161
Total		140	153	293

The coefficient of colligation between milk fat, 3·68 per cent. and above, and calvings in January–June, 1909 = −0·096 ± 0·039.

The coefficients show that the date of calving had no appreciable influence upon the average quality of the milk yielded subsequently.

The test of the colligation coefficients, while rough and approximate, serves to confirm the conclusions arrived at in the paragraph on "Homogeneity of Material" (p. 7).

This subject would probably bear further examination by

the more rigid method of tabulating and correlating the records according to the calvings in each month; but for the investigation in hand it seems clear that the shorter calculations made above are sufficient to show that the records are not rendered appreciably heterogeneous by the inclusion of cows calving successively through the period of about eighteen months.

Calculation of Correlation Coefficients.

The method followed in this calculation was that indicated by Mr. G. U. Yule in his "Introduction to the Theory of Statistics" (First Edition, pages 237 to 239). From the coefficients of zero order (total coefficients) those of first order were derived, and from the latter those of second order (the net or partial coefficients for the present investigation) were derived. This method results in the values of the coefficients of second order being given twice by different combinations of the coefficients of lower order. If the arithmetic is correct throughout, and sufficient places of decimals have been taken, these two values should be, of course, identical, and thus check each other. In the writer's calculations the values differed slightly in the third place of decimals in every instance and in some instances they differed also slightly when approximated to the second place of decimals. After carefully reworking and checking the calculations, the differing values have been averaged and are given to the second place of decimals. In no case do these differences affect the deductions which may be drawn from the values of the coefficients.

The coefficients of each order are shown with their probable errors in the following tables. The letter r in the left-hand column of each table signifies "coefficient of correlation." The numerical subscripts refer to the variables correlated, viz.,

1. Per cent. of milk fat.
2. Average weekly yield.
3. Duration of lactation.
4. Age of cow.

Thus, r_{12} signifies the coefficient of correlation between the percentage of milk fat and the average weekly yield. In Table 11, $r_{12.3}$ signifies the coefficient of correlation between

the same pair of variables, after eliminating the influence, if any, of the duration of lactation. In Table 12, $r_{12.34}$ signifies the coefficient of correlation between the same pair of variables, after the influence, if any, both of the duration of lactation and of the age of the cow has been eliminated. It is the coefficients in Table 12, termed "net" or "partial" coefficients, which measure the direct interdependence of the variables.

Table 10.

Correlation Coefficients of Zero Order.

Coefficient.	Value	Probable Error.
r_{12}	$-0{\cdot}3469$	$\pm 0{\cdot}0241$
r_{13}	$+0{\cdot}0471$	$\pm 0{\cdot}0275$
r_{14}	$-0{\cdot}2744$	$\pm 0{\cdot}0255$
r_{23}	$+0{\cdot}0501$	$\pm 0{\cdot}0275$
r_{24}	$+0{\cdot}4353$	$\pm 0{\cdot}0223$
r_{34}	$+0{\cdot}1130$	$\pm 0{\cdot}0272$

Table 11.

Correlation Coefficients of First Order.

Coefficient.	Value.	Coefficient	Value
$r_{12.3}$	$-0{\cdot}3671$	$r_{23.1}$	$+0{\cdot}0586$
$r_{12.4}$	$-0{\cdot}2682$	$r_{23.4}$	$+0{\cdot}0012$
$r_{13.2}$	$+0{\cdot}0570$	$r_{24.1}$	$+0{\cdot}2596$
$r_{13.4}$	$+0{\cdot}0735$	$r_{24.3}$	$+0{\cdot}4680$
$r_{14.2}$	$-0{\cdot}1415$	$r_{34.1}$	$+0{\cdot}1143$
$r_{14.3}$	$-0{\cdot}3042$	$r_{34.2}$	$+0{\cdot}1245$

Table 12.

Correlation Coefficients of Second Order, being the Partial or Net Coefficients for the Four Variables.

Coefficient.	Value.	Probable Error.
$r_{12.34}$	$-0{\cdot}27$	$\pm 0{\cdot}026$
$r_{13.24}$	$+0{\cdot}07$	$\pm 0{\cdot}027$
$r_{14.23}$	$-0{\cdot}16$	$\pm 0{\cdot}027$
$r_{23.14}$	$+0{\cdot}03$	$\pm 0{\cdot}028$
$r_{24.13}$	$+0{\cdot}27$	$\pm 0{\cdot}026$
$r_{34.12}$	$+0{\cdot}12$	$\pm 0{\cdot}027$

Significance of the Partial Correlation Coefficients.

The probable error of each coefficient forms the test of its significance. In order that the value of the coefficient may be considered to be definitely significant of the existence of a relationship between the two variables, it should be about five times as large as its probable error. After applying this criterion to the coefficients in Table 12, the following conclusions may be drawn :—

(1) After allowance has been made for the varying age and duration of the lactation period of the Ayrshire cows under examination, the milk of cows which gave the larger average weekly yields of milk shows a definite and appreciable tendency to be poorer in milk fat than the milk of cows which gave lower average weekly yields ($r_{12,34} = -0{\cdot}27 \pm 0{\cdot}026$).

(2) The duration of lactation had no significant influence upon the average percentage of milk fat produced ($r_{13,24} = +0{\cdot}07 \pm 0{\cdot}027$).

(3) The percentage of milk fat showed a slight, but definite, tendency to be lower in the older than in the younger cows, after due allowance has been made for the average weekly yield of milk ($r_{14,23} = -0{\cdot}16 \pm 0{\cdot}027$).

(4) Taking the herd as a whole, the duration of the lactation bore no relation to the average weekly yield of milk produced by the cows ($r_{23,14} = +0{\cdot}03 \pm 0{\cdot}028$). There is thus no evidence, in the Fenwick herds, of a selective action in favour of retaining in milk those cows that gave a better average yield of milk than others.

(5) In the herd under examination, the older cows show a definite and appreciable tendency to give larger yields of milk than the younger cows ($r_{24,13} = +0{\cdot}27 \pm 0{\cdot}026$). This may possibly be due partly to a selective action in weeding out cows which proved unpromising as regards their milk yield when young, and partly to a physiological tendency for older cows to give better yields than younger ones. To what extent, however, the tendency may be due to selective or to physiological causes, the coefficient, as it stands, does not permit of determination.

(6) The duration of lactation has possibly tended to be longer in older than in younger cows. On this point, how-

ever, the evidence is not quite definite ($r_{34.12} = +0{\cdot}12 \pm 0{\cdot}027$). The existence of such a tendency might be due to selective action in weeding out from the herd those cows whose lactation was rather short, or to physiological causes, tending to extend the duration of lactation in older cows. The value of the coefficient, however, makes it doubtful whether either tendency really exists.

Regression Equation.

The equation, termed a regression equation, which expresses the most probable value of a deviation from the mean percentage of fat in terms of deviations from the means of the other variables, is given below.

Let x_1 = a deviation from the average percentage of milk fat;
" x_2 = " " " weekly yield;
" x_3 = " " " duration of lactation;
" x_4 = " " " age of cows.

$$\text{Then } x_1 = -0{\cdot}022\, x_2 + 0{\cdot}002\, x_3 - 0{\cdot}018\, x_4.$$

Supposing the duration of lactation and age of cows not to be varied (*i.e.*, x_3 and x_4 each $= 0$), we have:—

If $x_2 = +1$ gallon, then $x_1 = -0{\cdot}022$ per cent.
" $x_2 = +2$ gallons " $x_1 = -0{\cdot}044$ "
" $x_2 = +4$ " " $x_1 = -0{\cdot}088$ "

In words, the average weekly yield might be increased by four gallons per cow, and the average percentage of milk fat would most probably diminish by not more than 0·09 per cent. From the above equation the equation expressing the absolute percentage of milk fat in terms of the absolute values of the other variables is calculated to be

$$\begin{aligned}\text{Per cent. of milk fat} = 4{\cdot}067 &- 0{\cdot}022 \times \text{Average Weekly Yield} \\ &+ 0{\cdot}002 \times \text{Duration of Lactation} \\ &- 0{\cdot}018 \times \text{Age of Cows}\end{aligned}$$

The dominant factor on the right-hand side of this equation is the weekly yield, which averages 16·83 gallons with a standard deviation of 4·07 gallons, and is multiplied by 0·022. The duration of lactation is absolutely larger, but is only multiplied by 0·002.

If we may suppose the average age and duration of lactation to remain unaltered, it appears possible to select a herd with an average yield of nearly 800 gallons per cow per lactation (as compared with the 1909 average yield of 637 gallons), without reducing the average percentage of milk fat produced in the herd as a whole below 3·58 per cent., as compared with the present average of 3·68 per cent. It must be borne in mind, however, that while this result may be regarded as the most probable, in the long run the certainty of attaining it diminishes when only a small number of cows is being dealt with, and increases proportionately with the number of cows in the herd in which the policy of selecting cows with higher milk yields is pursued.

APPENDIX A. 1. Average Percentage of Milk Fat.

4. Age of Cows (years).

	2·7-	2.8-	2·9	3·0-	3·1	3·2	3·3	3·4	3·5	3·6	3·7	3·8	3·9	4·0-	4·1-	4·2-	4·3-	4·4-	4·5-	4·6	4·7-	4·8–9	Total.
2							1	1	2	4	1	1	2		2	2							16
3				1	2	3	8	12	14	11	16	21	13	6	4	6	2	2	2	1			124
4			1	2	1	2	10	14	5	15	19	13	9	7	8	6	2		2				116
5			1	1	1	4	8	7	9	14	17	11	8	5	5	2	2		3			1	99
6			1	1	3	5	6	6	15	6	4	6	2	1	2	3					1		62
7				1	2	3	1	7		7	5	3	3	2	1		1						36
8				3	4	2	5	4	5	5	2	5		1	1								37
9	1					1	1	7	3	6	5	1	2	4	1								32
10						3	1	3	5	2	2	1	4		1	1							23
11				1	1	1	3	3	1	1	1	1	1	1									15
12		1			1	2	3		2		1	2											12
13					1		2	1				1											5
14				1			1			1													3
15						1	1	1		1													4
16									1														1
17						1																	1
Total	1	1	3	11	16	28	51	66	62	73	73	66	44	27	25	20	7	2	7	1	1	1	586

$r_{14} = 0·2744 \pm 0·0255$ $r_{14\cdot 23} = -0·16 \pm 0·027.$

APPENDIX B.

1. Average Percentage of Milk Fat.

	6-	7-	8-	9-	10-	11-	12-	13-	14-	15-	16-	17-	18-	19-
2·7-														
2·8-														
2·9-									1				1	
3·0-								1	1			1	2	1
3·1-						1			1	1		1		1
3·2-							1	3		2	2	4	2	3
3·3-				1		1	3		5	5	4	7	3	7
3·4-		1	2	1	1	4	2	2	7	12	6	1	5	3
3·5-		1		3	1	2	2	3	6	5	5	7	3	6
3·6-	1			1		2	5	6	8	8	16	5	4	4
3·7-						3	2	3	10	6	12	10	8	10
3·8-		1		1	5	3	11	9	4	7	7	5	3	3
3·9-			1	1	2	4	2	6	3	3	5	3	5	2
4·0-	1					1	4	4	3	3	2	5		1
4·1-		1			2	1	1	3	2	5	4	4		
4·2-					2	4	2	1	8	1	1			
4·3-				1					2	2				1
4·4-											1	1		
4·5-				1	1			2	2	1				
4·6-				1										
4·7-							1							
4·8–9							1							
Total... ...	2	4	3	11	14	26	37	43	63	61	65	54	36	42

$r_{12} = -0·3469 \pm 0·0241.$

2. Average Weekly Yield of Milk (gallons).

20-	21-	22-	23-	24-	25-	26-	27-	28-	29-	30-	31-	32-	33-	34-5	Total.
		1													1
1															1
					1										3
2	1	1	1												11
1	4	4					1				1				16
1	1	3		2	2	1	1								28
4	4	6	1												51
7	2	1	3	3		1			1					1	66
5	2	4	1	3			2			1					62
4	4		4	1											73
3	4		1		1										73
4	1	1			1										66
1	1	1	2	1					1						44
1	1	1													27
	1	1													25
	1														20
	1														7
															2
															7
															1
															1
															1
34	28	24	13	10	5	2	4	0	2	1	1	0	0	1	586

$r_{12,34} = -0{\cdot}27 \pm 0{\cdot}026.$

APPENDIX C.

1. Average Percentage of Milk Fat.

	8-	10-	12-	14-	16-	18-	20-	22-	24-	26-	28-	30-	32-	34-	36-	38-	40-	42-	44-	46-
2·7-							1													
2·8-													1							
2·9-								1					1	1						
3·0-		1		2							1			2	2	1	1		1	
3·1-					1			1		2					2	3	2	3		1
3·2-								1	2		3	2	1	3	2	3	2	3	4	
3·3-						1	1			1	1	8	2	3	3	2	6	6	5	4
3·4-						1			3	2	7	8	2	10	3	4	7	6	4	4
3·5-	1		1		1			1		4	1	4	4	11	6	4	4	2	6	2
3·6-							3		3	1	7	5	5	7	4	12	6	6	4	4
3·7-								1	1	5	2	5	3	8	10	5	8	8	5	4
3·8-							2		1	2	2	4	4	7	6	4	14	5	5	2
3·9-					1		1	1	1	3	1	1	4	4	2	7	6	4	2	2
4·0-									1				2	1	6	5	4	5	2	
4·1-					1				1	2	3	2		3		5	1	3	1	
4·2-					2		1				1	1	2	2	2	1	1	1	2	1
4·3-							1		1					2		2				1
4·4-													1				1			
4·5-										1		1	2			1		1	1	
4·6-				1																
4·7-																	1			
4·8-9																				
Total	1	1	1	3	6	2	10	6	14	23	29	41	34	64	48	59	64	53	42	25

$r_{13} = +0{\cdot}0471 \pm 0{\cdot}0275.$

3. Duration of Lactation (weeks).

48-	50-	52-	54-	56-	58-	60-	62-	64-	66-	68-	70-	72-	74-	76-	78-	80-	82-	84-	86-8	Total
																				1
																				1
																				3
																				11
1																				16
1						1														28
2	2		2				1												1	51
1	1	1		1							1									66
3	4			1		1			1											62
2	1		1	1				1												73
3		3		2																73
3	1		3		1															66
1		1	1									1								44
													1							27
1						1	1													25
	2	1																		20
																				7
																				2
																				7
																				1
																				1
																1				1
18	11	6	7	5	1	3	2	1	1	0	1	1	1	0	0	1	0	0	1	586

$r_{13.24} = +0{\cdot}07 \pm 0{\cdot}027.$

APPENDIX D.

2. Average Weekly Yield of Milk (gallons).

	8-	10-	12-	14-	16-	18-	20-	22-	24-	26-	28-	30-	32-	34-	36-	38-	40-	42	44-	46-
6-											1						1			
7-												2			1				1	
8-									1				1							
9-				1						2		1	1	1	1	1			2	
10-					2					2	1	1	2	1	2	1		1		
11-						1		1		2	2	1	2	1	3	2	2	6	1	
12-							2	1		1	1	5	2	2	5	2	7	1	1	1
13-				1			2	2	4	1	1	2	1	8	1	5	3	3	5	1
14-					1		2		4	3	3	4	4	12	4	7	7	3	4	3
15-					1		1	1		2	5	7	2	7	1	6	8	5	6	3
16-									1	4	5	5		2	4	10	8	8	4	1
17	1								1	2	4	4	4	3	7	7	6	6	2	
18-				1			1		1	3			3	3	4	4	5	4	3	2
19-						1	1		1		1	2	5	5	3	2	4	2	6	4
20-									1		1	1	1	5	6	4	2	3	2	4
21-					1						1	1	2	3	1	4	2	5	1	4
22-		1					1				1	2		3	2	2	4	3	1	
23-												1	3	2	2	1		1	1	2
24-												1	1	4		1		1	2	
25-								1						1			3			
26-											1							1		
27-					1							1		1	1					
28-																				
29-																	2			
30-			1																	
31-										1										
32-																				
33-																				
34-5											1									
Total	1	1	1	3	6	2	10	6	14	23	29	41	34	64	48	59	64	53	42	25

$r_{23} = +0{\cdot}0501 \pm 0{\cdot}0275.$

3. Duration of Lactation (weeks).

48	50	52	54	56-	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86 8	Total
																				2
																				4
		1																		3
1																				11
						1														14
	1							1												26
2		1	1				1									1				37
			1		1							1								43
	1		1																	63
1	1			2			1				1									61
5	2	3		2									1							65
5	2																			54
	1		1																	36
1	1		1	1		1														42
	1	1	1						1											34
1	1																		1	28
2			1			1														24
																				13
																				10
																				5
																				2
																				4
																				0
																				2
																				1
																				1
																				0
																				0
																				1
1	11	6	7	5	1	3	2	1	1	0	1	1	1	0	0	1	0	0	1	586

$r_{23\,14} = +0{\cdot}03 \pm 0{\cdot}028.$

APPENDIX E.

4. Age of Cow (years).

	8-	10-	12-	14-	16-	18-	20-	22-	24-	26-	28-	30-	32-	34-	36-	38-	40-	42-	44-	46-
2					2		1			2		2		1	2	1		1	2	1
3	1	1		1	1		5	1	6	8	6	9	9	10	9	10	8	10	7	4
4				1		1	2	1	3	4	5	7	5	12	12	18	17	11	10	1
5					2			1	1	4	4	9	7	15	6	11	10	8	7	3
6						1		1		1	4	4	4	9	3	5	10	8	2	5
7					1				2	1	3	1	2	6	1	6	5	1	1	3
8				1			1			1	3	3	1	6	4	2	3	4	2	1
9							1	1		1	1	3	1	3	2	2	3	6	3	1
10									2		1	1	2	2	2	1	2	2	2	3
11												1	1		3	2	4	2	2	
12			1							1	1		1		2	1			1	2
13											1						1		1	1
14												1					1		1	
15								1					1		2					
16																				
17																			1	
Total.	1	1	1	3	6	2	10	6	14	23	29	41	34	64	48	59	64	53	42	25

$r_{34} = +0{\cdot}1130 \pm 0{\cdot}0272.$

3. Duration of Lactation (weeks).

48-	50-	52-	54-	56	58-	60-	62-	64-	66-	68-	70-	72-	74-	76-	78-	80-	82-	84-	86-8	Total.
1																				16
5	3	3	4	1	1		1													124
2	1	1		1									1							116
3	3		1			1		1				1				1				99
1	1	2	1																	62
1				2																36
1	2		1				1													37
1				1					1		1									32
2						1														23
																				15
1	1																			12
																			1	5
																				3
																				4
						1														1
																				1
18	11	6	7	5	1	3	2	1	1	0	1	1	1	0	0	1	0	0	1	586

$r_{34 \cdot 12} = +0{\cdot}12 \pm 0{\cdot}027.$

APPENDIX F. 2. Average Weekly Yield of Milk (gallons).

Age of Cow (years).	6-	7-	8-	9-	10-	11	12	13	14	15-	16	17-	18	19-	20-	21-	22	23-	24	25	26-	27-	28-	29	30-	31-	32-	33-	34-5	Total.
2		1			1		1	2	5	2	2	2																		16
3	1	1	3	5	9	10	16	13	20	18	10	6	7	2	1	1	1													124
4	1	2		2	2	10	10	14	16	7	17	11	5	7	4	2	2	2		2										116
5				3	2	3	5	7	12	14	12	11	7	8	4	7	2	1				1								99
6						3	2	2	4	6	7	4	5	6	6	3	5	3	3	1		1		1						62
7							1	2	2	2	3	6	1	5	1	2	2	2	4	1		1							1	36
8									1	2	4	5	5	2	5	3	6	1	1			1		1						37
9							2			4	2	3	5	3	6	2	2	1	1	1										32
10								2	1	1	1	3		5	3	4	1	1			1									23
11									1	3	1		1	1	1	3	1	2	1											15
12											4	3		1	1						1				1	1				12
13										2				1	1	1														5
14									1		2																			3
15				1				1						1	1															4
16																	1													1
17																	1													1
Total.	2	4	3	11	14	26	37	43	63	61	65	54	36	42	34	28	24	13	10	5	2	4	0	2	1	1	0	0	1	586

$r_{24} = +0.4353 \pm 0.0223.$ $r_{24 \cdot 13} = +0.27 \pm 0.026.$

R. CLAY AND SONS, LIMITED, BRUNSWICK ST., STAMFORD ST., S.E., AND BUNGAY, SUFFOLK.

Supplement

TO

The Journal

OF THE

BOARD OF AGRICULTURE

SUPPLEMENT No. 12. JANUARY, 1914.

REPORT

ON

THE POSSIBILITY OF REVIVING THE FLAX INDUSTRY IN GREAT BRITAIN.

LONDON
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PREVIOUS SUPPLEMENTS TO THE JOURNAL OF THE BOARD OF AGRICULTURE.

IN 1911 Dr. J. Vargas Eyre was requested by the Development Commissioners to inquire into and report on the possibility, both from a scientific and practical point of view, of reviving the flax industry in this country. His Report to the Development Commissioners is of such interest and value that it has been thought desirable to issue it in the form of a Supplement to the Journal of the Board of Agriculture, in order that farmers may avail themselves of the practical details brought together. An article on "The Growing of Linseed for Feeding Purposes" was published in the *Journal* in August, 1913, and a leaflet based on that article has already been issued. The present Report, however, deals much more fully with the possibilities of reviving the flax industry in Great Britain, and the Board hope that its publication in its present form will serve a useful purpose.

BOARD OF AGRICULTURE AND FISHERIES,
4, WHITEHALL PLACE,
LONDON, S.W.

January, 1914.

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THE POSSIBILITY OF REVIVING THE FLAX INDUSTRY IN GREAT BRITAIN.

DR. J. VARGAS EYRE.

INTRODUCTION

HISTORICAL REVIEW.

FLAX-GROWING in England probably dates from the Roman occupation, although practically nothing is to be found among official records until A.D. 1175, when flax was included among tithable articles. Presumably, at that time the cultivation of the crop had attained to considerable dimensions In 1532 (*vide* 24, Henry VIII cap. 14) an Act was passed which compelled all persons holding tillage land to sow at least one rood with flax for every 60 acres of such land occupied. This law was made more stringent in 1562, when a penalty of £5 was imposed upon persons not growing at least one acre of flax for every 60 acres of land cultivated (*vide* 5, Eliz. cap. 5).

With the object of still further encouraging the growth of flax in England, the tithe on this commodity was reduced to four shillings per acre in 1691 (3 Will. and Mary cap. 3) and in 1712 a bounty of one penny per ell was given on all exported British-made sail cloth (*vide* 1713, 12 Anne, cap. 16). In 1806 a bounty was offered for the importation of flax from British Colonies, and every effort was made to increase the production of fibre at home, so as to supply more completely the requirements of a growing British industry. At that time flax was grown more or less in every part of England, and in many counties several thousand acres were annually under this crop ; but the supply of raw material did not keep pace with the home demand, as may be seen from the Parliamentary Returns for that period, which show fairly large imports of flax.

Flax suffered considerable depreciation for some time after the introduction of cotton, and the successful machine spinning of that fibre still further reduced the demand for linen, since it was impossible for that material to compete with the low price of cotton fabrics. About 1820 steam-driven flax-spinning machinery became commercially successful and there arose an increased demand for flax fibre, but at that time the difference between the price realised for a flax crop and for a wheat

crop was insufficient to induce the better farmers of this country to embark again on the troublesome preparation of fibre. It seems to have been due to the fact that only low quality flax was prepared in this country that British flax culture fell into discredit, and while a diminishing quantity was grown in England, the amount imported steadily increased. To take one county as an example, there were in 1810 between 4,000 and 5,000 acres of flax annually grown in Dorset, but in 1850 only 300 acres. The Board of Trade Returns show that in the year 1842 55,000 tons of fibre were imported into this country, but as much as 70,900 tons in 1845.

Writing in the Journal of the Royal Agricultural Society of England in 1847, J. MacAdam states that the great markets for flax to supply the spinning trade were Leeds, Belfast and Dundee ; the finest yarns being made by the English spinners, the great bulk of medium yarns by Irish manufacturers, and Scotland producing generally the very coarsest. MacAdam advocated the more extensive cultivation of flax in the United Kingdom, and showed with no little clearness that a profit of £10 an acre was obtainable at that time provided cultivation proceeded on proper lines. There was a revival of English flax-growing about 1850, but development was arrested by the greatly enhanced price of corn, so that flax was, for the time being, outclassed as a farm crop. Furthermore, following the Treaty of Paris, 1856, and peace with Russia, very large quantities of cheap Russian fibre came to British markets ; and this seems to have been the blow from which English flax production has never properly recovered, although various attempts have been made to restart the industry.

One of the many difficulties in the way of extending flax cultivation in the United Kingdom was the firmly seated opinion of a large number of people, formed from casual observation, that flax is a particularly exhausting crop.* So pronounced was this belief that provisions were inserted in leases which sometimes prohibited flax cultivation, but generally limited tenants in this respect.

Somewhat extensive flax growing and fibre production in England is still within the memory of many people in certain rural parts of the country, but, at the present day, there is little to indicate the extent of this lost industry. The names

* This opinion dates from very early times, flax being stigmatised as a hurtful and exhausting crop by Greek and Roman writers. *Vide* Columella, lib. ii, cap. X. Virgil, Georg., lib. i, V. 77, and Pliny, Nat. Hist., lib. XIX, *proaem.*

of such places as Flaxton (Yorkshire), Little-Steeping (Lincolnshire), Retford (Notts), and Flax-Bourton (Somersetshire) seem to be some of the best evidence for locating the scene of flax cultivation in the past. Separation of the fibre from the straw was part of the agricultural practice in England, just as it is in Russia at the present day, the cleansing and preparation of the fibre providing work during winter months for the husbandman and his family.

The custom of working large farms and the increased price of produce which required less attention and less skilled labour occasioned a decline in the area devoted to flax and a marked disinclination on the part of agriculturists to do more than grow the crop and harvest it. The establishment of depôts for receiving the straw for the purpose of working it up for fibre marked a new stage in the history of English flax and seems to have been the last support upon which the industry rested.

In view of the present-day policy of encouraging the small-holder of land, and to induce a return to agricultural pursuits, it is of interest to note that a serious endeavour to find employment for a redundant population led to the establishment of a very successful warm water rettery for flax at Eye in Suffolk soon after 1860. About that period a revival of the flax industry took place, considerable quantities were grown, and in 1870 the area devoted to flax-growing in Great Britain was 23,957 acres, the greatest area devoted to the crop in any year for which exact records exist.

About 1875 a repetition of bad seasons for flax-growing was experienced in England, and this, together with the keen competition of foreign flax fibre and Manilla hemp on the English market, and the high price of wheat, caused many farmers to cease growing flax, and soon afterwards several flax works closed down.

To judge by the quantity of flax dealt with annually, the most prosperous mills about that time were those at Selby and Staddlethorp in Yorkshire. At the former the crop from nearly 2,000 acres was handled successfully, but, in company with the few remaining mills which continued to operate, the quantity handled fell off considerably in subsequent years until in 1896 not more than a 500 acre crop was dealt with at Selby, and at the mills at Staddlethorp a crop of barely 200 acres. It is, however, significant that both the mills surviving in 1896 were conducted as central retteries, where the principle of retting in tanks of warmed water had been adopted.

Flax works were established at Long Melford in Suffolk in 1876 and continued working for many years. It appears, however, that the price paid for the crop was high, and, the quality of the straw being inferior, financial difficulties arose which necessitated closing the factory. Flax-growing in Suffolk declined rapidly after 1884, and in 1889 only 4 acres were grown. Since 1888 several smaller attempts have been made to revive the flax industry in Suffolk, but without success; in fact, it may be said that the results were the reverse of successful, because failure to meet obligations and to pay farmers for raising crops has made people in some districts exceedingly sceptical about flax.

In 1896 all the flax mills in Suffolk and Lincolnshire were idle, the cause of failure being in most cases attributed to want of capital, and want of confidence on the part of the growers that they would receive fair treatment at the hands of the mill management Flax has been grown in England as a fibre crop to a very small extent during the last 25 years. Small areas have been seen from time to time in Yorkshire, and also in Somerset where there is still some grown which is dew-retted and sold locally.

In Great Britain flax has always been harvested both for its fibre and for its seed, although the former has been the chief object in view. Quite recently, however, it has been receiving attention as a seed crop, the price of linseed having risen to such an extent that it has become a profitable crop in England for seed alone. In 1910 linseed was grown as a farm crop on some 15 acres near Ely, and proved profitable although the straw was sacrificed. It was also grown under experimental conditions on several farms in North Wales under the guidance of the University College Agricultural Department. In 1911 about the same acreage was devoted to linseed near Ely and it again proved a remunerative crop.

This, briefly, is the history of the flax industry in Great Britain. Having regard to the results of recent experimental work, to the many conflicting statements relating to flax cultivation and to the merits of the large number of processes by which the fibre may be separated from the straw, it is thought desirable to give seriatim some account of the cultivation of the crop and the separation of the fibre therefrom, before entering upon considerations regarding the revival of the industry in this country.

I.—CONSIDERATIONS OF SOIL.

Nature of Land.—There is no little diversity of opinion as to the particular soil which is best suited for the production of flax as a fibre crop. It is frequently stated that well-drained loam gives the best results and rich loamy clays are considered to be very favourable. There are some people who hold the opinion that the nature of the soil is of small importance and others that good flax can only be raised on good rich soil. From a general examination of the soil in the principal European flax-growing areas it appears that there is much truth in all these statements, good flax being raised on a great variety of soils provided the texture is suitable. Careful selection of any particular soil is of minor importance compared with the preparation of the land prior to sowing, and is altogether outweighed by the importance of securing reliable seed. Very heavy clay soil is not favourable for flax, neither is chalk, and there is good evidence for saying that peaty moorland or soil which is very rich in humus is unfavourable, but almost any other clean land which is capable of producing good crops of grain will produce good crops of flax.

The flax plant grows very rapidly, sending down many fine filamentous roots as far beneath the surface of the soil as the stem rises above it. The subsoil therefore must be of a kind which will allow of root development to the full, and at the same time be sufficiently compact to offer a firm hold for the plant. It is of great importance to the production of good uniform fibre that the plant should develop at a steady rate and receive no check during growth. It is best, therefore, to grow flax upon soil which is not readily affected by drought and where the subsoil does not become waterlogged during a wet period. Although rich land will produce what appears to be a splendid crop of healthy tall plants, these are found when examined to yield an amount of fibre not at all in proportion to the luxuriant growth and which is at the same time of a lower value for spinning purposes: the large amount of foliage and seed is produced at the expense of fibre.

Although stress is laid upon the advisability of sowing flax on rich fertile soil, strong deep loam, it is a singular circumstance that most of the good flax grown is produced on very light soil, often on sand. In Ireland the best flax comes from a gravel soil with gravel subsoil; in the north of France excellent flax is grown on a very light sandy loam; and the soil of East Flanders is very similar to the French, although

it differs from it in containing more sand and in being in a better condition owing to intensive cultivation having prevailed in Belgium for so long. The flax soil of West Flanders is somewhat heavier than that of East Flanders, containing a larger proportion of clay, and in some cases approaching the composition of the heavier marlish-loam known in Holland as "Zeeklei." This is a deposit of sand rich in clay which is widely distributed; it "weathers" readily, forming a good porous firm soil, and it may be said that flax cultivation in Holland is confined to the regions of this particular deposit.

The flax districts of Russia are so extensive that it is difficult to formulate a general statement as to the class of soil yielding the best crop. It may be said, however, that the chief characteristic is lightness, the soil being composed largely of sand. The poor, sandy, scrub-land between Vologda and Tver produces flax of excellent quality, and when farming operations are properly conducted some remarkably good crops are raised. This type of soil extends eastward as far as Viatka and Perm, and the whole is a flax-growing area, but in the western provinces of Pskoff, Vitbesk, Livonia, Kurland, and Kovno the soil is somewhat heavier in consequence of the widely distributed moraine matter in those regions; in some cases there is as much as 20 per cent. of clay present.

In order to facilitate comparison of the soils mentioned, the following figures may be taken as generally representing the type of soil upon which good flax is raised; but it must be remembered that considerations of soil composition are insignificant compared with the state of subdivision of the soil.

—	N. France.	East Flanders.	West Flanders.	Holland N. Prov.	Russia West.
	%	%	%	%	%
Sand	78	94	85	55	80
Clay	15	4	12	30	15
Humus	3	2	2	6	4
Limestone ..	0 2	—	—	5	1

Judging from these figures the soil upon which good flax is grown appears to be a light loam and does not seem to differ very much in the various countries mentioned.

Preparation of Soil.—Flax is a delicate crop to grow and there are several matters of cultivation which require special

attention. Regarding the soil, one of the main factors which make for success is the care with which the soil is prepared for the seed. The importance of cultivating the land to a high degree of fineness is to be emphasised, for therein lies much of the secret of success. Not only must the soil be fine, but it must be firmly bedded. It would be difficult to lay too great stress upon the fact that the seed bed must be deeply worked and firm, with a shallow surface layer of fine soil to cover the seed. Flax seed germinates rapidly and requires food almost at once in an easily assimilable form. The finer the soil and the more compact it is, the more easily will it present moisture and nourishment to the delicate root, and therefore, the better the growth will be. In development the plant sends a fine root system far down into the ground in an almost perpendicular direction so that the area from which it is able to derive nourishment is greatly restricted if these conditions of soil preparation are not fulfilled.

Manure.—Although flax has long been specially cultivated for the fibre it bears, it is only comparatively recently that attempts have been made to evolve a system of manuring the crop so as to harvest better fibre. Flax is a short crop; it is only on the land 10 or 12 weeks, and probably for that reason requires its nutritive material to be in an easily assimilable form, which means that the application of manure can only be profitably made after a thorough knowledge of the land has been acquired.

A good manurial dressing for flax land depends largely upon the condition of the land and the nature of the soil, and is to be found out only by experience At the same time there are certain recognised practices which are deleterious to flax and some which are profitable. Of the former it may be said that to plough stable manure into the land prior to a flax crop is bad because it enriches the land unevenly, causing local luxuriant growth and consequently an uneven harvest, an evil which shows itself in subsequent processes to which the crop is submitted. If this manure, or any fresh animal manure is to be used, the land should be well dressed with it the season before it carries a flax crop, so as to get more uniform distribution, and then the addition of artificial manure will be all the flax will require. Besides causing unevenness, stable manure is universally condemned because it induces a large growth of foliage and woody material without any equivalent increase of fibre; it is also stated on good authority that the fibre borne by such plants, besides being present in small

amount, is decidedly coarser and of less value. Except in certain cases, a similar evil attends the use of phosphates, with the additional disadvantage of an enhanced crop of weeds on the field. Nitrates are sometimes useful in bringing along a backward crop, but great care has to be exercised in their use, because of a tendency to cause weakness in the fibre and a weak crop generally.

Flax has been clearly shown to be a potash feeding plant, requiring a good supply of this food material for its rapid assimilation. An analysis of the straw shows that potash and lime are its chief mineral constituents, a fact which partly explains why this crop grows so much better on the new " Polder " land in Holland than it does on the old, there being more lime and potash in the soil recently reclaimed from the sea. Among the many experiments which have been carried out, both at home and abroad, to ascertain the effects of various kinds of manures on the economic cultivation of flax, the systematic series carried out by the Department of Agriculture for Ireland affords the most valuable guide to successful manuring.

Place in Rotation.—The best place for flax to occupy in the scheme of crop rotation is to some extent dependent upon the soil, upon what is the most marketable produce, and upon the manure available ; no hard and fast rules are possible owing to these and other varying circumstances. It is certainly an unwise practice to grow flax frequently on the same land, because a condition of " *flax-sickness* " sets in, a soil trouble about which little is known. Reasons have already been given for dressing the land with animal manure at least a year prior to the flax crop. When the soil is rather heavy, it is sometimes made to carry two or more crops between a dung manure and a flax crop. For instance, in Friesland, the land is well dunged for potatoes ; the next year sugar-beet is grown with artificial manures ; in the third year oats are grown with artificial manures ; and in the fourth year a suitable dressing of artificial manure is given for a flax crop.

A very general practice in all countries is to sow flax after oats, or at any rate after some crop which will leave the land as far as possible free from weeds : such as chicory, which necessitates earth disturbance late in the year ; or hemp, which so completely shadows the soil that weeds do not grow. When the soil is poor in nitrogen, the last oat crop is sown with clover and a clover crop taken before flax is sown ; but, where the soil is not deficient in nitrogen, leguminous crops

are kept well removed from flax and a crop of chicory is taken between oats and flax. Many growers in Russia and Holland hold the opinion very strongly that it is best to grow flax on land which has been under grass for two or three years.

Usual Crop Rotation practised in Flax-Growing Countries.

Year	1	2	3.	4	5	6	7.	8.	9
Ireland	Roots	Oats	Hay	Pasture.	Pasture	Pasture	Oats	Flax	—
Normandy	—	—	—	Sugar-beet	Oats	Clover	Wheat	Flax	—
Brittany..	—	—	Barley	Clover.	Clover	Wheat	Oats	Flax	—
W.Flanders	Clover	Wheat	Potatoes.	Barley.	Oats	Chicory	Flax	Flax	—
Zeeland	Wheat	Beans	Sugar-beet.	Barley.	Beans	Rye	Grass	Grass	Flax
Friesland	Roots	Oats	Clover	Potatoes	Sugar-beet	Oats	Flax	—	—
Groningen	Wheat	Beans	Barley.	Clover	Oats.	Wheat	Sugar-beet	Oats	Flax
Livonia	Fallow	Rye	Barley.	Potatoes	Fallow	Rye	Clover	Oats	Flax
Smolensk	Fallow	Rye.	Clover	Oats	Wheat.	Hay	Pasture	Flax	—
Pskoff	Wheat	Barley	Oats	Rye	Pasture	Flax	—	—	—
Scrublands	Rye	Oats	Barley	Flax	Flax	Flax	Flax	Flax	Scrub, 10 years
Austria Trautenau	Rye	Potatoes	Oats	Clover	Clover	Wheat	Flax	—	—

II.—CONDITIONS OF GROWTH.

Climate.—It is probable that the conditions under which flax is grown at the present time are not at all natural to the plant: the production of tall straight stems, with little seed and much fibre, having been brought about by long cultivation under particular conditions At the present time growers strive to produce long uniform slender stems carrying as much fibre as possible and as little woody material as is compatible with proper stem rigidity, and to do this to the best advantage, certain climatic conditions are essential.

The growing period of flax is only 10 or 12 weeks, and of that time the early stages are the most critical. When once started the plants grow very rapidly, especially during the month of June, when an increase of 1¼-1½ inches occurs during a period of 24 hours. Unless the soil is able to retain a good supply of moisture, or frequent light rain falls, this rapid growth receives a check, or is arrested: the fibre then becomes coarse and irregular, instead of increasing in length.

Although linseed may be successfully grown in districts where the climate is warm and where the heat of the summer is seldom alleviated by a shower of rain, these conditions do

not admit of flax fibre being profitably raised. Quite a cool, temperate climate is best suited for the production of good fibre. A moist atmosphere, frequent showers and a moderately low uniform temperature are the best conditions where the soil is light; but, where the soil is capable of retaining a good supply of moisture and occasional showers fall during June, a hot, dry spell of weather at the latter period of growth is very advantageous to the crop as it causes an increased yield of fibre.

It is noticeable how generally flax-growing areas are situated near to the sea coast where the crop benefits by the moist wind and generally uniform climate. Flax is extensively grown in Normandy, Brittany, and Picardy, in France; in the northern part of Ireland; for about 50 miles inland from the Belgian coast; in Zeeland and the islands of South Holland, as well as along the coast of Friesland and Groningen in North Holland and extensively in the Baltic Provinces of Russia. All these districts enjoy similar climatic conditions during the growing period, rather low, even temperature, rather high humidity, and nearly equal rainfall.

It is remarkable also to observe that really good flax is cultivated in the northern parts of Russia where frost does not leave the land until the end of April and returns again before November, and where the maximum temperature of the year is about 60° F.

Rainfall.—Fibre grown in cool, moist regions is fine, silky, and possesses good spinning quality; that produced in a district where the summer is hot and dry, is short, harsh and dry. This influence of climate on the quality of the fibre is markedly shown in the French and Belgian crops of 1910 and 1911 the former year being wet and the latter unusually dry. Generally speaking the fibre from the 1910 crop was long, fine, silky and moist, whilst that from the 1911 crop was short, strong, harsh and dry. It may be said that 1910 gave a weft flax and 1911 a warp flax.

As regards rainfall, there is no unusual requirement; June is the critical month for flax growth and it is then that frequent showers are necessary.

Demand on Soil.—It has frequently been stated that flax is an exhausting crop for the land, a statement which is based upon the fact that flax is a crop only profitably repeated on the same land after an interval of several years. This belief finds expression in some land agreements where the tenant is specifi-

cally prohibited from growing flax, or is forbidden to remove both the seed and the straw from the farm. Although this belief has been contradicted from time to time, the refutatory evidence brought forward has not received due credence because the fact remains that flax crops cannot be successfully repeated at frequent intervals upon the same land as in the case of other farm crops. The reason for this is at present rather obscure, but in the light of the experimental work of Snyder, Wolff, Hodge, Tretiakov, and others, there can be no doubt that flax removes, if not less, at any rate not more, nutritive material from the soil than do other farm crops.

The work of Prof. Snyder is of particular interest in this connection, and it is from his results that the following table has been compiled to show the comparative demand made by various crops upon the soil.

Average crop in bushels per acre	Crop.	Pounds of Nitrogen	Phosp acid.	Potash.	Lime.	Silica	Ash
20	Wheat ..	35	20	35	8	116	210
40	Barley ..	40	20	38	9	72	216
50	Oats ..	50	18	45	11	75	205
30	Peas ..	—	25	60	75	10	240
10	Mangolds .	75	35	150	30	10	350
150	Potatoes ..	40	26	75	25	4	125
15	Flax ..	54	18	27	16	35	87

Among the points of interest which are brought out by this table the fact is that a mangold crop cannot usefully precede flax because of its large withdrawal of nitrogen and potash—substances upon which flax largely depends for its rapid growth. It is also evident that a crop of flax is no more exhausting to the soil than is an ordinary grain crop.

Other evidence has also been furnished from the North Dakota Experimental Station, where it has been demonstrated that better crops of wheat may be raised after flax than after wheat. Professor Bolley, when writing upon this subject, cites the confirmatory work carried out at Poltava by Professor Tretiakov, showing the demand on the soil to be less for flax than for wheat, even when water evaporation is taken into consideration. One hundred kilogrammes of field soil were shown by analysis to retain more soluble matter after the

removal of a flax crop than after the removal of spring wheat, the tabulated results being :—

—	Mineral matter	Soluble Nitrogen	Soluble Phosphates.
After Wheat ..	22.8 grms.	0.20 grms	0 17 grms.
After Flax ..	23 6 ,,	0 21 ,,	0 29 ,,

The moisture in the soil under these crops was also determined in a layer of soil 21 inches deep, and found to be (*a*) under wheat 13.9 per cent., (*b*) under flax 14.3 per cent.

Other investigators, namely Wolff and Hodge, have examined the mineral content of various parts of the flax plant with the object of ascertaining what proportion of mineral food is removed from the soil by the stems and what it is possible to replace by using the chaff and seed as cattle food The analysis of fresh flax is given by Wolff as follows :—

> Fresh flax contains 0.94 per cent. potash, 0.4 per cent. phosp. acid; linseed contains 1 per cent. potash, 1.35 per cent. phosp. acid, 3.18 per cent. nitrogen; capsules contain 1.54 per cent. potash, 0.45 per cent. phosp. acid.

Dr. Hodge gave the average weight of a flax plant as 4.6 grammes, of which about 2.5 grammes were stem and 2 grammes branches and capsules, and he found the whole plant to be composed of 56 per cent. water, 42 per cent. organic matter, and 1.4 per cent. ash. His analysis of the ash affords valuable information regarding the nature and quantity of the mineral constituents withdrawn from the soil.

	Analysis of ash of stems Per cent.	Analysis of ash of capsules without seed Per cent.
Potash	20.3	16.4
Soda	2.1	6.2
Sodium chloride..	9.3	13.0
Lime	19.19	13.9
Phosp. acid ..	10.2	23.2
Carbonic acid ..	10.7	6.3
Silica	12.8	0.6

III.—SEED FOR SOWING.

Varieties.—A number of forms of flax are cultivated at the present day and they exhibit differences sufficiently well-marked for them to be classified by some authorities into varieties of several species. Flax, however, responds so markedly to changes of climate or soil conditions that in some of these cases it is difficult to regard the differences noticed in the habit as being other than due to varying conditions of growth or environment.

1. *Linum usitatissimum vulgare*	.. ..	blue
,, ,, ,, (*album*)	..	white.
,, ,, *regale*	.. ..	blue.
2. ,, *americanum album* ..	.. ..	white.
3. ,, *hyemale romanum* ..	.. ..	blue.

Some of these forms are undoubtedly better suited to certain soils than are others; for instance, on the heavier land of Friesland, the coarser-growing white flowering flax (*L. usit.* var. *album*) is exclusively grown, whereas, on the adjacent new "Polder" land the blue flax (*L. usit.* var. *vulgare*) is found to be more successful; but, in other regions, where white flowering flax was formerly grown it has been found more profitable to grow the blue. It is noteworthy that Riga white flowering flax is less liable to disease and gives a heavier return of fibre than Riga blue flowering flax, although its quality, more particularly its fineness, is not equal to that of the latter.

Although in all other European countries emphasis is laid upon the necessity of frequently changing flax seed, the country from which the best flax seed is obtainable—*Russia*—knows no such necessity. In Russia, it is generally accepted that the best seed for fibre production comes from the Baltic Provinces and the Provinces of Pskoff and Vologda, and when occasion arises Russian growers obtain seed from these districts for their own use. The best fibre and the best flax-seed are exported from the Provinces mentioned, and the crops are almost invariably grown from seed of the previous harvest, change of seed not being an agricultural consideration. In many cases the farmers have had their seed in the family for more than 20 years, and although the present day sees smaller yields of fibre than formerly, there is no such deterioration as is said to take place in Holland and Belgium after growing

from the same seed successively for four or five years only. Russian seed undoubtedly gives a more uniform and more healthy crop than any other, notwithstanding the fact that, owing to increased railway facilities, the time has now passed when it was possible to say that reputed Pskoff seed came from that Province, or that Riga seed came from the Baltic Provinces.

It is a very noteworthy and general practice in the best flax areas of Russia to dry the seed finally in an oven at a comparatively high temperature. Besides ensuring thorough drying this operation probably acts beneficially in killing off imperfectly developed and poor seeds so that only those of a uniform and high vitality remain. Certainly this process of oven drying is beneficial quite apart from merely preventing subsequent heating of the seed when in barrels during transit, and may account for the fact that Russian seed gives better crops, although the percentage of dead seeds is higher than with any other. Not only has oven-heating been found advantageous to the subsequent flax crop, but if the seed is submitted to several degrees of frost a similar result is observed; it is no uncommon practice for Russian peasants to expose their seed to the action of frost with the object of improving the quality of the flax harvest raised therefrom

In Western Europe the prevailing opinion seems to be that it is necessary frequently to change the seed used for sowing, a fresh stock being obtained, preferably from Russia, but at any rate from some more northern country. Other growers, however, maintain that this is not so necessary as is generally claimed, and in support of their argument they cite the fact that Russian growers seldom, if ever, change their seed. In Friesland also, where the white flowering variety (*L. usit.* var. *album*) is grown, a change of seed is rather a rare occurrence, and when it is made, instead of the importation of fresh stock from Russia, more frequently involves a change from one part of the Province to another, the soil being practically the same.

Many who have carefully studied flax growing, freely express the belief that it is a plant which rapidly degenerates, and for this view there appears to be much support; at least, it is a plant which very readily adapts itself to new conditions of soil and climate. Although the exact conditions of trial are not often given it is frequently recorded in Holland and elsewhere how the characteristics of good fibre flax become lost by repeatedly growing it. Seed which at the outset yields a healthy crop of tall, straight-stemmed flax yields a shorter crop, coarser in stem, much more branched and very

subject to disease when grown for four or five years successively without change. Not only this; but Russian "original" seed, which gave only blue flowers in Russia, is authentically recorded to become changed under certain circumstances to the white flowering form. This remarkable statement was made on several occasions by people who had cultivated flax for many years; certainly, when this apparently uniform seed is grown in France, Belgium or Holland, it always gives a crop containing in the first year numerous plants with white flowers.

Another instance of change of habit, but in the opposite direction, was met with in Russia. Some seed of the shorter growing, branching flax, which is grown for seed in South Russia, had been taken up north into the cooler and moist region where flax is exclusively grown as a fibre crop. The first year's crop from this seed was short, like the original "Steppe-Flax," but after four or five years repeated growing, excellent tall crops were obtained which yielded fibre equal to the crops usually produced in the district.

Sources of Supply.—As already mentioned, the general practice is to rely upon Russia for the supply of flax seed to all countries; the imported seed coming chiefly from the Baltic Provinces by way of Riga. It is then grown in other countries for about three seasons, giving rise to crops bearing seed known as "Riga Child" and "Riga Grandchild." Where the climate is moist and dull, "original" Russian seed gives the best results, especially if the soil be light; where the prevailing atmospheric conditions are dry or the soil is somewhat heavy, better results are obtained by using "Child" seed, although the crops raised therefrom are less uniform than from Russian seed. In Belgium, the best practice is to procure "Dutch-Riga-Child" from some reliable source, that particular seed known to come from a good crop of fibre flax in Holland the preceding year being the most highly prized. Seed in Holland is better ripened naturally in the field than in other countries, and large quantities of "Dutch-Riga-Child" are sown in Holland, Belgium, Ireland, and France, where in many cases it is sought after in preference to Russian "original" seed.

Possibly this may be partly explained by the interesting and quite general observation that whereas Russian "original"

Note.—Results of germination tests are only of use in fixing the price and the rate of sowing, and should not alone be taken as indicating a good or a bad seed.

seed produces crops richer in fibre, the "Child" seed shows its superiority in producing crops bearing fibre of finer and better quality.

Preparation for Market.—In addition to this, it is possible for those who collect Dutch grown seed for export to ascertain what the seed has done in the past and to collect only the best for distribution to flax growers; and, as only about 10 per cent. of the Dutch crops are from seed other than that freshly imported from Riga, one can be fairly certain that the seed is Dutch-Riga-Child when offered in Holland under that name. This is not yet possible in Russia, where seed merchants mostly have to buy in small quantities from agents or middlemen who collect the seed in smaller quantities from peasant farmers. The Russian merchant has therefore to deal with a great variety of types and is only able to grade his seed according to general appearance, colour, shape, size, &c., and to take care that "Steppe Seed" does not enter into his mixtures. By long experience merchants have found that seed from a region of certain conditions of climate produces seed better suited for exportation to one country than another; for example, seed from a very wet district does better in the drier climate of Holland than in Ireland, while seed from a drier region is better suited to the damp climate of the north of Ireland. This kind of practical information stands the export merchants in good stead and the accuracy of their judgment is quite remarkable; at present, no other course is open to them, although the more intelligent admit the advantage of ascertaining something of the history of the seed they export.

IV.—CULTIVATION.

Sowing.—It is claimed in some quarters to be an advantageous practice to sow flax as late in the season as possible, because this allows the land to be cleaned of seedling weeds before the sowing of the flax crop. However true this may be for certain land where weeds are plentiful, it must be questioned whether flax is a suitable crop there; moreover, the advantages of this practice are far outweighed by those attending early sowing. The best advice is to sow as early as possible, as early as the soil and weather will permit, so that the seed will germinate slowly and have a good start while moisture is in the top soil and thus produce a uniform crop of flax.

It is possible to sow earlier upon light soils than upon heavy soils. Flax cannot stand cold, wet conditions, so that heavier land will require a longer time to arrive at a sufficiently dry state to admit of sowing seed. Usually, it is possible to sow on light soils at the commencement of April, whereas the end of April is generally sufficiently early for the heavier land such as occurs in Friesland, but varying influences have to be taken into account and only the farmer can properly say when his land is in proper condition. The seed bed must be of fine tilth, and it is best to sow on a harrowed rather than on a rolled surface.

For the production of a tall uniform flax crop it is necessary to sow the seed somewhat thickly, and although errors may be made in the direction of sowing too freely, faults are more often seen in sowing too thinly. This is the worse error because it allows the plants to take on a broader growth and to branch lower down the stem than would be the case were they closer together. Thin sowing brings about an increased yield of seed, but the fibre, for which the crop is grown, suffers in being coarser, shorter and smaller in quantity. The thicker the crop is sown the taller will be the plants before branching, and consequently the yield of fibre will be greater and of a finer quality; but, of course there are limits to this beyond which it is foolish to go.

Some of the highest rates of sowing in Ireland are from 1¾ to 2 bushels per statute acre; whereas in Holland and Belgium as much as 3 bushels per statute acre are used.

Before sowing it is necessary to ascertain the germinating quality of the seed, because in some cases this varies rather widely. Russian seed generally contains a larger proportion of dead seeds than Dutch seed, and it is wise to make an allowance for this difference when sowing. For example, Russian seed germinating only 75 to 80 per cent. will not go as far as Dutch seed germinating 95 per cent., and this is about the extent of the differences found. The following figures may be taken as a guide in making allowances for seed germination:—

If 100 per cent.	germinates,	1½	bushels	per statute	acre.
,, 90 ,,	,,	1¾	,,	,,	,,
,, 80 ,,	,,	2	,,	,,	,,

It is also found desirable to sow more thickly on heavy soil than on light soil, presumably because in the former case more of the seeds die off. The differences are not large, but are worthy of notice when deciding upon how much seed to employ. On the very light soil in N. Belgium 2 bushels of seed, 80 per cent.

germinating, are sown to the statute acre; on the loam soil in France 2¼ bushels, and on the new Polder land in Groningen as much as 3 bushels per statute acre are sown.

For the most part sowing is done by hand, more especially in Ireland and Russia: it requires exceptionally calm weather* and great skill on the part of the sower to obtain anything like an even distribution of this small, slippery seed. A small portable distributing machine known as the Violin is extensively used in Holland, Ireland and Belgium. It is so called because of the to-and-fro motion of a bow-like handle necessary to actuate a distributing wheel which is fitted at the base of the small reservoir containing the seed. This simple little machine is carried under the left arm of the sower and is steadily worked with the right hand as it is carried at a uniform pace over the field: with it much of the difficulty attending sowing has been minimised.

Few farmers show any inclination to drill the seed by ordinary machines or by any modification of them, although this method of sowing, besides ensuring even distribution, has the advantage of bedding the seed at a uniform depth. This is a very important thing to achieve, because when deposited at varying depths irregular germination follows and an irregular crop is the result. This is very strikingly observed with the flax crop. To some extent this method of sowing is adopted in Ireland, but the instances in other countries are quite few. Where large areas have to be sown, and where labour for weeding is not plentiful, this method of sowing presents economic advantages, because the crop may afterwards be well cleaned by hoeing instead of hand-weeding.

Flax must not be sown deeply; about half an inch is quite sufficient and the rows should be about four inches apart. After sowing the field should be lightly harrowed crosswise and finally rolled lightly so as to consolidate the surface and make it flat.

Weeding.—It is to be assumed that well-farmed land is tolerably free from weeds, and that flax is only sown upon land which has been suitably cultivated during the previous season so as to reduce weeds to a minimum; but the very nature of the conditions of flax cultivation, and the growth of the plant itself, seem to be favourable to the growth of weeds, so that a flax crop upon relatively clean land is often

* In many instances sowing is done at dawn when the air is unusually calm.

threatened by damage of this kind. Convolvulus must be eradicated, and weeds which make large and bulky growth, such as thistles, dock and charlock, must be removed at an early stage if good flax is to be harvested, and other weeds must be kept down during the early stages of the growing flax. Hand-weeding is generally resorted to while the flax is quite short ; and if the weeders make use of specially soft footwear, the flax is scarcely damaged at all. In Holland and Belgium weeding is very carefully and thoroughly done by women and children who go barefooted about the field, and, kneeling to weed, go systematically through the field twice and sometimes three times during the months of May and June. As far as could be ascertained, the farmers reckon on procuring one weeder for every acre of flax, and as soon as the weeding is completed once a fresh start is immediately made and the field is gone over a second time. Although the wages paid for this class of labour are small (1s. to 1s 6d. per day of about 12 hours), the cost of weeding in these countries when outside labour has to be procured adds greatly to the cost of cultivation. Very often, however, the small farmer has a family sufficiently large to enable him to provide most of the labour required for this purpose from his own household.

In France, and also in Ireland, the necessity of repeated careful hand-weeding is not recognised, although convolvulus and the larger weeds such as thistles and charlock are summarily dealt with. Excellent flax crops are to be seen in Ireland and also in the north of France, where some of the finest quality flax is raised and taken to Belgium to be retted. The necessity for close weeding as practised in Holland and Belgium appears therefore to be somewhat overestimated. When large areas of flax are cultivated, hand-weeding is impossible unless a large amount of labour can be put into the field at once so as to get it done before the flax plants grow so tall that they are damaged by treading under foot. Instead of sowing broadcast, it then appears to be a more advantageous practice, and certainly more economical, to drill the seed so that the young crop may be cleaned subsequently by careful hoeing instead of hand-weeding.

As is well known, charlock may be got rid of to a large extent and the growth of thistles may be greatly retarded by spraying with a solution of copper sulphate. When the spray is applied to a flax crop no harm is done to the flax, but it is well to remember that this remedy must be applied at a very early stage if it is to be successful : the weeds to be

dealt with should be only about 2—3 inches high and it is doubtful whether white charlock—smooth leaf—is affected at all.

Corn Spurrey (*Spergula arvensis*) and Knotweed (*Polygonum aviculare*) are bad weeds, as also are the Persicarias (*Polygonum Persicaria* and *Polygonum lapathifolium*) because of their staining property and the difficulty of separating their seeds from the linseed. *Lolium temulentum* and *Lolium linicola* are both poisonous weeds which sometimes accompany linseed.

Parasitic weeds must be mentioned under this section, because one of them, namely, the Flax Dodder (*Cuscuta epilinum*), attaches itself to the flax plant, derives its nourishment therefrom and flourishes to the detriment of its host.

Manurial Dressing.—In Ireland it has been found that a certain local condition of soil occasions a scarcity of some of the plants' requisite foods, causing small areas of the flax to become yellow and sickly in condition, somewhat resembling what is known as the "Chlorotic state." Rain showers frequently revive the flax, but when no rain falls a slight dressing of muriate of potash has the effect of restoring the flax to a healthy condition. Save in exceptional cases, it is not customary to apply top-dressings to flax, but should a spell of dry weather retard the early growth of the crop it is well to apply a light dressing of nitrate of soda, but it must be used with moderation, and is only to be given with the object of just preventing the crop from receiving an early check to its development.

Diseases and Pests.—Of the several diseases to which flax is subject, few only make themselves sufficiently prominent to call for special notice here; as a rule they are of small significance and do not cause the farmer anxiety. It is, however, probable that certain serious troubles which arise when the fabric is bleached are to be traced to the presence of diseased straws in the crop from which the fibre was obtained.

At an early stage of growth, when the plants are only about two inches above the ground, they are sometimes subject to a fungoid disease called "yellowing," which is stated to be due to the fungus *Asterocystis radicis.*[1] At a later stage of growth "*Flax wilt*" sometimes affects the crop; this disease is attributed to the joint activity of several micro-organisms, of which the most definitely identified is *Fusarium lini.* It spreads rapidly from the seat of infection and sometimes wipes out large areas of flax and has rendered flax growing impossible in certain districts of America, although in Western Europe this disease is seldom met with.

It is of importance to mention that some species of field flax are markedly resistant if not quite immune to these fungoid attacks.

Flax is also subject to the ravages of several ***insect pests***, the more important being the grubs of the Silver Y-moth (*Plusia gamma*) which feed upon the flax blossoms, the larvæ of *Thrips linaria* and *Phyllotreta nemorum*, and also the Flax-flea-beetle (*Longitarsus ater*). Of these the latter are the worse insect pests; they eat off the young plants, and may spoil considerable areas. Others are *Conchylis epilinana* and *Thrips cphisopus* which destroy the seeds in the capsule and the young buds respectively. Fortunately these insect pests are not met with to any considerable extent.

V.—HARVESTING.

It is undoubtedly deleterious to the fibre if flax straw is allowed to remain standing until the seed is ripe; the fibre thereby loses much in quality, becoming dry and brittle, besides ultimately weighing less. These change are ascribed tentatively to the seed draining the plant of its oily sap. Only where the crop is grown expressly for seed is it allowed to become quite ripe before being harvested; when grown for fibre, harvesting the seed is either entirely neglected in the endeavour to obtain particularly good fibre, or it is regarded as of secondary importance only.

There are, however, but few places where the seed borne by the plant is entirely sacrificed. Sometimes this is done in Belgium, where small quantities of flax are harvested almost as soon as the crop comes well into blossom, with the oldest seeds on the plants just changing to the green stage of development. The object of harvesting at such an early stage is to obtain fibre of the very finest kind and of the greatest elasticity and silkiness, for which there is some limited demand, for specially fine lace work. Apart from these instances it appears that Ireland is the only flax-growing country where the asset of seed saving is entirely disregarded.

To grow flax primarily for fibre and secondarily for seed is certainly the most advantageous course to pursue, and, that the fibre may suffer as little as possible, it behoves the farmer to harvest his flax crop at a stage when the seed has become developed just sufficiently to be of practical value.

This stage is not difficult to determine, and after a little practice errors in judging the best harvest time will be small: besides, to harvest a little too soon is to the advantage of the fibre, while a slightly delayed harvest is to the advantage of the seed, so that some small degree of latitude is afforded without materially harming the crop as a whole.

It is everywhere agreed that the best practice is to harvest flax when the lower part of the stem begins to change from green to yellow—when about a third of the stem has so changed, and when the leaves to about one half up the stem have changed colour and fallen. At that stage an examination of the seeds within the capsule shows them to be just changing from a full green colour to a brownish tint. These are the general signs that the crop has matured sufficiently and harvest operations should commence at once. Efforts should be made to harvest the crop as near the same stage of ripeness as possible; no delay is allowable because, during warm summer weather, ripening processes proceed rapidly.

Pulling.—Flax is universally harvested by pulling it from the ground by hand labour. It is strongly maintained to be a bad practice to cut it. Why exactly this should be so is not easy to understand, because, when the root end of flax straw is examined it is found to carry very little fibre indeed, up to at least one inch or an inch and a half above soil level, so that little fibre would be wasted by close cutting the crop. The level nature of the land would allow the machine to be set very close to the ground, so that the loss of fibre would be very small and outweighed by the advantage of a less expensive method of harvesting. The main advantage of pulling over cutting seems to lie in getting up the crop more or less free from weeds. When the crop has been allowed to get weedy this certainly is an advantage, but seeing that at a later stage, when the seed is separated from the straw, an equally good opportunity is afforded of getting rid of weeds and grading the straw into bundles of uniform length, it seems doubtful economy to hand-pull the crop. Possibly, however, there are weighty reasons for adopting this expensive method of harvesting flax, which have not come to the writer's notice. In Ireland, where no seed separation is practised it would seem to be a good thing to hand-pull the crop and have done with it, rather than sort out the weeds after cutting.

Flax is only pulled during dry weather. It is hard work, because of the stooping attitude necessary, and it is mostly done by men, women being employed to tie up and "stook"

the sheaves. The whole operation has to be completed as quickly as possible, necessitating really hard work on the part of those employed. The amount of labour required for pulling will, of course, depend upon the time allowed for doing it—a fair estimate being four men or one man per acre according as pulling is to be done in one day or during three or four days.

The flax is grasped rather low down on the stem in small handfuls and is pulled up with as few weeds as possible, the earth is knocked down from the roots against the puller's boot, and, keeping the root ends as level as possible, a large handful is accumulated until no more can be held. These large handfuls are laid down on the ground for the women to collect together, "even up" and tie into larger bundles or sheaves by twisting a few straws round the heads just below the seed bolls. Great care is exercised in making up these bundles, which must be really neat and uniform with level root ends.

In Russian flax-growing districts the crop is pulled greener than in Holland and Belgium, and less care is taken to make up even sheaves. In the Baltic provinces, as the bundles are tied up they are collected by young people and brought to a part of the field where an arrangement is erected for cutting off the seed-bolls and for trimming up the sheaves. These are slashed down on to a curved blade fixed to a stout post so that projecting straws are cut off and the flax is then ready for water steeping or dew retting according to the custom of the particular locality.

In Ireland a somewhat different practice obtains; the pullers themselves lay the uprooted flax as neatly as they can across a dry twisted rush band, until sufficient has been collected to tie up to form a sheaf, or as it is locally called, a "beet." As no attempt is made to save the seed there is no opportunity for evening up the sheaves after they are once made up, so it is of the greatest importance to have the flax tied up uniformly and carefully in the first instance. If the steeping pit is close at hand and ready to receive the flax, the sheaves are carted from the field at once and placed in the water. If circumstances prevent this being done the sheaves are "stooked" to await the first chance of being removed to the water. During dull weather it is not considered at all harmful to leave the flax standing in the field for some days, but should the weather be hot and sunny it is found that exposure to these weather conditions causes browning of the outside straw, making the fibre harsh and irregular in colour.

There is much disagreement as to the merits of green-straw retting over dry-straw retting when regarded simply as a means of preparing the best quality fibre, and this is quite apart from the question of saving seed, because it will be shown subsequently that in either case the seed may be saved.

In Ireland, Russia and certain localities in Belgium, green-straw retting is advocated as being the better method, the fibre prepared in this way being said to be of superior quality; on the other hand, the best fibre of all comes from Belgium and is prepared from straw which has not only been dried well, but has been kept until the following year before being retted. The character of the growing season, the temperature and nature of the water in which the straw is retted, all play a more prominent part in determining what class of fibre will eventually be obtained, so that it is difficult to ascribe distinctive merit to either method of retting It is to be lamented that no serious effort has been made to obtain reliable information on this point. Judging from information acquired in different districts it may be that each method has some particular advantage,* although the opinion was formed that to dry the straw first before retting is the better practice. It is therefore of importance to record the various methods of drying flax straw which are adopted in the various countries.

Drying Flax Straw.—The general practice in France, Belgium and Holland is to allow the flax to dry in the field for some time before anything else is done with it, the object in view being to allow the seed to ripen so as to be of practical value for sowing purposes and for the expression of oil, and at the same time to avoid heating when stacked together in large quantities. It has already been pointed out that to let the crop stand until the seed is sufficiently mature is to the detriment of the fibre, but it is found that when the crop is pulled and allowed to remain dry, the seed continues to develop like other cereals, without the fibre suffering; indeed it is frequently stated on good authority that the fibre improves by keeping in a dry state for some time. Many people store their best crops of flax straw until the following year. To allow the "after ripening" of the seed to take place the crop is left in the field

* Green-straw retting may possibly favour the production of a fibre which is finer and more silky in character and the dry-straw method may produce a fibre which is stronger than the other but the evidence in favour of this view is not very conclusive.

and allowed to remain dry a sufficiently long time for the process to go as far as possible.

To this end the Belgian farmer lays two long poles on the ground close together and after the straw has remained "shocked up" in the field for a day or two, it is removed and laid across the poles in a uniform direction so as to build up a wall of flax sheaves which is propped at frequent intervals to take wind pressure, and is roughly thatched with rye straw. By this arrangement the flax straw is protected from rain and sun, and at the same time the wind has a fair chance of penetrating the wall so that after some seven or eight days it becomes sufficiently dry for the seed to be removed.

The custom in Holland, especially in Groningen and Friesland, is somewhat different from that in Belgium. In the former province, after preliminary drying the sheaves are built around a roughly constructed wooden tripod, such as is used for drying clover, and in this manner they are left for about a week so that the seed may mature and get dry. The advantage claimed for this method is that it affords a freer circulation of air throughout the mass and at the same time the flax suffers little harm by rain and sun.

In Friesland the sheaves are built up into small ricks which are protected at the top by a cloth covering or a light thatch of green rushes cut from a neighbouring ditch. Generally the flax remains like this until an opportunity offers itself of taking off the seed and retting the straw, or, if it has been purchased by a Belgian merchant, as more frequently happens, until it is put on board a barge for transportation to the Lys to be retted.

In some parts of Russia, where the climate is wet, considerable difficulty is experienced in drying the crop, rain and inclement weather generally setting in before this can be accomplished in the ordinary way. For example, in the Government of Pskoff, not far from Dedoviezy, such unfavourable weather conditions obtain that natural drying ceases to be a practical possibility. It is maintained by a very enlightened farming landowner there, that to get good seed it must ripen on the plant after pulling, and to get good fibre the straw must be well dried before it is retted, both postulations being in agreement with the Belgian and Dutch practice. So as to be able to work on these lines and to dry the flax properly large drying sheds with open sides have been erected and fitted with lattice shelves upon which the flax is laid as soon as it is pulled.

When thoroughly dry the seed is taken off and the straw is stored in a closed barn until the following year, when it is retted.

Again, in the neighbourhood of Rsheff, after the crop is pulled and has been allowed to dry out of doors as far as the climate allows, it is removed to a drying house where it is artificially dried in an oven before the seed is removed.

Seed Separation.—The methods of separating the seed from flax straw are almost as numerous as the countries where the crop is grown. Ordinary machine thrashing is to be strictly avoided if the straw is to be of much value for subsequent retting, because this method occasions serious damage to the fibre. It is customary in the North of France to sell all the better flax to dealers who take it to Belgium, so that only the poorer quality is left in France. The flax remaining is generally spread on the ground as soon as it is pulled, for the dual purposes of "dew retting" the straw and of allowing the "after-ripening" of the seed to take place. When the seed is sufficiently ripened, the straw is lifted and the seed is taken off by a process known as "rippling" and the straw is again spread on the ground for retting to continue.

Separating flax seed by "rippling" is commonly carried out in Holland as well as in France for, although in both these countries much of the flax grown is sent to Belgium, the seed usually remains the property of the farmer, who takes it off either after the seed has been allowed to "after-ripen" in the field and in the stack or as soon as the crop is pulled. Sometimes the whole crop is purchased by a dealer who takes it away, and after removing the seed himself during the winter sells the straw to be retted.

"Rippling" is effected by drawing the top part of the straw through a vertically placed iron comb which does not allow the seed capsules to pass between the closely arranged pointed teeth. Men do the actual rippling, and women and children bring the sheaves, untie and retie them again.

So that no seed is lost, rippling is carried out over a large cloth spread on the field, or when the crop is stored until the next year, rippling is done in the barn where the straw is housed during the winter. Rippling affords an excellent opportunity for removing dead or diseased straws and for taking out any weeds which may have been included in the sheaves, as well as for grading the straw into bundles of approximately uniform length ready for steeping.

Besides being a good practical method of removing the seed, rippling has much in its favour as a means of straightening out the straw, and cleaning it from short pieces as well as from weeds. Some think it would be a profitable expenditure even if the value of the seed alone did not completely cover the cost of rippling, but the price of linseed is so high that the value of the seed removed more than defrays the cost of pulling as well as of rippling the crop.

Flax grown in Belgium is sometimes rippled as soon as it is pulled, after the manner described above, or, after being well dried the crop is deprived of the seed it carries by spreading it on an even stone floor and beating the top ends of the flax with flat wooden mallets : it is quite a feature of West Flanders, especially during the winter months, for the seed to be removed by this method. Without having the advantage of straightening out and cleaning the straw, this method of seed separation seems to necessitate the employment of as much labour as does rippling , moreover, it is doubtful whether the seed does not suffer by the treatment, the one advantage being that the seed is threshed out of the capsules at the same time.

In localities where flax is retted while in the green state, as soon as it is pulled, such as the neighbourhood of Lokern and St. Nicholas in Belgium, the seed capsules are "rippled" off and then spread out on canvas in the sun to dry.

The Russian methods of separating the seed from the straw also vary. In the Baltic Provinces and the Government of Pskoff a modified form of "ripple" is employed, the teeth of which are sharp knife-blades which cut off seed-pods and the small branches to which they are attached, leaving only the straight stems.

A different method of removing the seed is practised in the neighbourhood of Rsheff, in Russia ; there the artificially-dried flax straw is taken by the root end in handfuls at a time, and the tops only are passed between the ends of two revolving wooden rollers fixed at such a distance apart that the straw is practically untouched and yet close enough together to crush the seed capsules and to free the seed without damaging it.

Preparation of the Seed.—In those districts where the seed capsules are removed as soon as the flax is pulled, it is necessary to dry the seed if it is to be of any use. This is done in the Lokern district of Belgium by spreading and frequently turning the rippled capsules on a large cloth spread in a sunny situation.

When dry the capsules are threshed with a flail or are passed between rollers which crush them and liberate the enclosed seed.

The general practice in Western Russia is to cut off the top branches as well as the seed capsules from the flax straw, and these are collected together and closely packed on a vertical drying frame fixed in the field, where they remain until the seeds within the capsules have become of a uniform brown colour.

After drying on frames out-of-doors, the capsules are removed to a specially constructed drying shed and heated to a fairly high temperature until quite dry: an operation sometimes lasting two or three days, if the outdoor conditions were not favourable to drying.

They are then spread rather thickly over a stone floor and threshed, either with a flail, by simple machinery, by a horse, which drags a grooved wooden roller about the floor, or by some other convenient method. Finally the seed is sifted out and screened and sold to the local buyers who pass it on with their other purchases to people who properly clean and "grade it for export."

The Dutch practice is to separate the seed from the straw by hand labour during the winter months—by rippling, and sometimes it is done by means of a "flax-brake" which separates the seed capsules from the straw. The seed is very carefully threshed out and cleaned and prepared for the market by the farmer, who relies upon his "Riga-Child" seed making a good price. There is such a demand for this seed by French, Irish and Belgian growers that it pays the Dutch farmer to make the necessary outlay to procure good original Riga seed for his own use every year that he may have the "Child" seed for sale.

The Belgian practice of beating the seed capsules from the straw has the advantage of setting free the seed at the same time: and, after proper winnowing and screening, the seed is ready for market. Most of the Belgian seed is sold for the expression of oil.

Flax seed is known to suffer serious damage through becoming damp. It is capable of absorbing water, and thereby suffering deterioration, as well as becoming heated when stored in quantity. It is therefore better to keep the seed as long as possible unthreshed or at least with the chaff which will screen the seed from injury, as well as keep it dry. The necessity for avoiding old seed is commonly emphasised, and this is simply

because of the difficulty of keeping the seed in a good condition when once away from the capsule. This is recognised, unfortunately, by very few people; only in one district in Russia visited by the writer was it known that flax seed which had been kept a year or two in the capsule, or had been stored with the chaff, was of greater value than new seed which had been threshed and cleaned before storing. From the point of view of getting good seed for sowing, there is too much anxiety at present to get the seed threshed and cleaned.

VI.—THE FLAX STEM AND THE POSITION OF THE FIBRES.

For convenience of reference, the structure of a flax stem when viewed in section, may be considered as being composed of two parts or concentric rings—a complex cellular system forming the outer ring and a cell structure of greater simplicity forming the inner ring or woody part of the stem. The valuable part of the straw, namely, the fibre, forms a series of irregular bundles almost on the outside of the stem, their exact position being between two thin parenchymatous layers, one of which is just beneath the epidermis and the bounding cuticle, the other one being adjacent to the cambium. This briefly describes the formation of the outer layer, the complex cellular-system of which has to be partly broken down before the bundles of fibre can be obtained in a useful form. The inner part of the stem is made up of a ring of woody material of more or less uniform character and with this the fibre-winner has little to do. The long fibres composing the "bundles" already mentioned are themselves made up of long chains of shorter fibres which are held together and in position by an inter-cellular gum or resin (Pectose).

Successful separation of fibre from flax straw depends upon the isolation of the long fibres without going so far as to weaken the binding between the smaller individual fibres composing them. Up to the present time this pectose decomposition has been best accomplished by a natural fermentation process which sets in when the straw is allowed to "damp rot," a process which now goes by the name of "retting."

VII.—RETTING.

Before the harvested straw can be used by the spinner in the customary way it has to be put through several somewhat complicated processes, including retting, breaking, scutching, and hackling. All these operations were carried out formerly by the farmer who grew the straw ; but, of late, the tendency has been for these subsequent operations to get into the hands of people who specialise in one particular phase of fibre preparation. It is now a common practice for the farmer to sell his standing crop, the purchaser deciding when to harvest, and himself taking off the seed. The latter then sells the straw to somebody who rets it and then it passes into the hands of others who have specialised in scutching ; finally, it is bought by a dealer who sorts and grades his purchases and sells in large quantities to the spinner. This procedure is general in those districts where the higher qualities of flax are produced, and must be regarded as a consequence of these subsequent processes requiring greater skill in their performance than the average farmer is able to command.

Dew Retting.—It may be said generally that the best results are obtained when the straw has been dried and kept a year before being retted, and this applies to the simplest of all methods of retting, in which the straw is spread thinly over the ground to allow alternate dew, sunshine and rain to carry the process forward until the fibre is easily detachable from the wood. The very nature of this process, depending as it does upon favourable weather conditions, often gives rise to a product of very low value ; nevertheless, in some districts this method is the only one available, and enormous quantities of dew-retted flax are annually prepared.

One acre of standing flax may be said to require nearly two acres of land over which to spread it, the straw being laid down in regular rows, on grass land for preference. After two weeks it is advisable to turn the straw over, and if it has been regularly laid in the first instance this is easily accomplished by passing a thin stick under the top part of the straws and lifting them over. The time required for retting to go far enough depends upon weather conditions, but it may be said to require some five or six weeks. Sometimes in Belgium, and more often in Russia, winter-retting is practised, the flax straw remaining for months out in the field during the winter, without suffering much harm, the colour of the fibre obtained being quite pale.

In Western Europe only the poorer qualities of straw are dew-retted—crops which are not considered good enough to treat by other and more expensive methods. Fibre from dew-retted straw is of bad colour, but it bleaches well, the greatest drawback being that small spots which cannot be removed by bleaching frequently develop on the fibre.

Pit Retting.—A method of retting only seen in South Holland and East Flanders, more especially near Lokern and St. Nicholas, is to pack the deseeded and undried straw into long narrow ditches containing some two feet of water and then to cover the whole mass with sufficient mud, taken from the pit, so as to immerse the flax completely and prevent it rising above the liquid during retting. It is claimed that the water must be from a clay soil, the pit must be in clay, and that an improvement in the colour of the resulting fibre may be effected by placing green elm or alder foliage, or green clover into the water some weeks before the pit is to be used Alongside these retting pits near Lokern it is common to see pollard elm trees growing.

Like other fermentation processes, retting proceeds more quickly during warm weather, and as this process is carried on immediately after harvesting the crop in July it only requires from 8 to 10 days for the straw to be sufficiently decomposed. During the last few days it is carefully watched and tested, experience telling when it should be removed ; then the people employed get into the pit and carefully remove the bundles from the mud and water in which they have been immersed and stack them vertically to allow them to drain. This work is exceedingly unpleasant, more especially because of the powerful stench which arises when the bundles of straw are disturbed and taken from the mud. After draining for a few hours, and, if necessary, rinsing in cleaner water, the straw is spread over a stubble field or any other available land after the manner of dew-retting. There it remains, being turned once or twice, for a month or six weeks, when it is dried and taken to the barn to be kept until winter time before being cleaned and prepared for market.

The small farmer carries out all these processes himself, and although his methods of cleaning the fibre are quite primitive the product he obtains has a good name for softness and pliability. It is dark in colour, inclining to blue—this giving the name " Blue Flax "—but it bleaches easily and is sought after for certain purposes.

Pond Retting.—Of the retting processes which are still carried out by the farmer, probably "pond-retting" is the best, such as is practised in Ireland, France, Friesland and Russia with considerable success. This involves placing the tied-up straw into water and allowing it to remain there until properly retted. There are two distinct methods of water-retting (1) *a Floating Method*, and (2) a *Sinking Method;* of these the former is the older, and at the present time is carried on only in Friesland. It consists of floating the bundles of rippled and dried straw on the surface of a fairly large stretch of still water, with the bundles closely and regularly arranged. Every day they are turned over so that the side which was uppermost and out of the water is placed beneath the water next day. This work is carried out from the bank on either side by men who use a small prong fixed to the end of a light pole. When retting has proceeded far enough the bundles are removed and opened out to dry and then stored under cover until time can be spared to clean the fibre.

By far the better method of pond retting is to submerge the straw completely as in the Sinking method, or steeping. Probably there is no country where this is better carried out than in some parts of Ireland, and no place where more good flax is sacrificed to this method than in Russia. It is universally agreed that clay is the best land upon which to construct steeping ponds, and that soft water is the best with which to fill them, although it seems possible to ret flax successfully in almost any naturally occurring water which is free from iron. In Groningen and Zeeland retting is done in brackish water with moderate success.

Steeping ponds are usually long rectangular excavations made in the ground in the vicinity of a suitable water supply; they are mostly about five or six feet deep and vary in length and breadth according to requirements. An acre of flax requires an area of about 300 square feet of water for steeping purposes. The situation is largely governed by the facilities for getting water into the pond and for getting rid of the steep water after retting is finished. For the most part the ponds are simple excavations in the ground, with clay bottoms, although some are roughly paved to afford a firm bed to stand upon, while others have boarded sides to help in keeping the fibre clean. It is the usual practice to let sufficient water into the pond several weeks before use, and then to pack in the straw fairly tightly, keeping it submerged by weighting it down with large stones. In some districts, as in Ireland and

the Baltic Provinces, it is customary to ret the straw as soon as it is pulled from the field, but in other parts of Russia and also in Holland the straw is always dried first. Whatever the custom may be the best method of filling the retting pond is to arrange the bundles vertically, one row deep, with the root ends downwards so as to be in the cooler water, where retting proceeds more slowly than nearer the surface.

When the pond is completely filled, a light covering of straw, tree foliage or other suitable material is generally put over the flax and on the top of that sufficient stones are arranged to submerge the entire mass uniformly. The progress of retting is carefully watched, especially towards the end of the operation, when it is examined two or three times each day. The usual time for steeping is from ten to twelve days, and as fermentation proceeds during that period the flax is kept submerged by suitably altering the weight of stones resting on the top. When the adjudged point has been reached the straw is carefully removed from the pond and either spread over grass land or opened out and stood upon end to dry.

Mixed Retting.—This is a combination of pond retting and dew retting and is largely carried on in Russia. The flax straw is retted for about six or seven days in a pond, after the manner described, and then taken out and spread over suitable land, where retting continues until the fibre readily separates from the woody part of the straw.

River Retting—The methods of pond retting described are carried out with a relatively small proportion of water to the quantity of straw steeped. When larger volumes of water are used, or when the water is allowed to flow slowly through the pond, the colour of the resultant fibre is much paler, and when retting is carried out at the shore of a small lake or river, the colour of the fibre is almost white. These conditions of retting in large volumes of water seem to favour the production of fibre which is dry, or, as it is termed, of "low spinning quality." Probably this is due to a large extent to the removal of oily constituents from the immediate vicinity of the fibre.*

Double Retting.—For the production of high-class fibre, the method known as "Double-retting" stands before all others. It is practised with greatest perfection in Belgium in the neighbourhood of Courtrai, where, since the middle of the last century, flax has been systematically double-retted in the

* Experiments which would throw light upon this subject were planned some time ago by the Department of Agriculture and Technical Instruction for Ireland, but no results are yet available.

River Lys. At the present day, this method has reached a high state of development there.

The River Lys is naturally adapted to retting inasmuch as the water is very slow moving and the river bank slopes gently down to the water-edge. It is believed by many people that the water of this river is possessed of some special property, but this does not appear from the results of analysis. What probably is the cause of such successful retting in this river in particular is the slow movement of the water and the large amount of organic matter which it carries from towns situated some distance above the portion of its course devoted to retting. Bacterial development in these circumstances, aided by the enormous quantity of flax annually retted in the river, has resulted in the exceptionally favourable retting conditions which obtain at the present day.

Double retting originated and is now exclusively practised in the Lys district, the fibre produced being more highly priced than any other because of its quality and fineness. This method entails a considerable additional expenditure of labour over direct retting and for that reason only straw of the finest quality is retted in this manner, and of this the best is kept in barn storage for a year before it is retted, a practice which is believed to increase the strength of the fibre. The Lys retting period lasts from April 15th to October 15th, during which time the river is practically closed to traffic. For some twenty miles on either side of Courtrai a continuous row of closely-packed retting crates or "ballons" is to be seen near each bank of the river, and remarkable activity prevails during the whole period. On the river bank the straw is sorted into heaps of approximately equal length of straw, dead straws are removed and the various heaps are made up into bundles which are firmly tied in three places and made ready for steeping.

The Belgian custom is to pack these bundles vertically into wooden crates or "ballons" and then to sink the whole in the river. The "ballons" used vary somewhat in size and form; they usually measure about 10 ft. by 12 ft. by 4 ft. deep, and have a firm flat bottom, with the back and two sides closed, and the front and top open. To keep out mud and dirt from the river, sacking is placed along the back and sides of the "ballon" and then the straw bundles are tightly packed inside. Sacking is placed along the open front, an ample covering of straw is spread over the top and the full "ballon" is launched into the river and afterwards weighted down by

large stones so as to submerge completely the flax straw. During the summer months the temperature of the river water is about 20°-25° C. and first retting occupies nearly a week. As fermentation proceeds the "ballon" rises somewhat out of the water and therefore requires the weight of stones to be adjusted from time to time. At the close of the first retting period, which is determined by various observations made during the immersion, the "ballons" are hauled up on to the bank and emptied. The flax-straw is taken to an adjacent field where the bundles are opened and the straws arranged on end in steeple-form (small open sheaves) to dry thoroughly and evenly. At least once a day the steeples are re-arranged to bring the inside part to the outside so that drying may be as regular as possible.

After about three days the dried straw is collected together and given a rest period of about one month before being again sorted over, made up into bundles and packed into the "ballons" as was done in the first instance. Care is taken this time to arrange the bundles so that the end at the bottom during the first retting is placed at the top in the second retting. It is not considered necessary to cover the bundles with straw to protect the flax during second retting, so stones are laid upon boards which rest directly on the ends of the flax bundles.

The second retting does not take so long as the first retting, although the time necessary depends upon many variable factors, including temperature, quality of the original straw, extent of first retting, and nature of fibre required. To determine precisely when retting should be finally arrested requires very considerable knowledge and experience, aided by careful and frequently repeated examinations of the retting straw. When the conditions are satisfactory the "ballons" are removed from the river, and the flax bundles taken out and dried in the manner already described.

Warm Water Retting.—Like other fermentation processes, retting may be accelerated by raising the temperature of the water in which the flax is steeped; the decomposition of the intercellular gummy material requires under these conditions only two or three days instead of nearly a fortnight. This fact, although known long previously, was first made use of practically by Schenk (1846) who devised a method of retting flax straw in warmed water. Since that innovation many retting establishments have been organised and worked on this principle in various countries, including England, and provided the farmers grew sufficient flax, the retting establish-

ments generally speaking met with moderate success. The chief drawback to the successful working of many of them seems to have been want of capital, and the large premises necessary for carrying on the work.

The Irish Flax Improvement Society investigated warmed water retting processes as regards the strength, bleaching quality and yield of fibre obtained, and were able to report favourably on this system of fibre separation.

In 1853 it is recorded that as many as 20 warmed water retteries were at work in Ireland alone, and of the flax mills in England, those which had adopted retting in warmed water at a Central Depôt were the last to close down ; as recently as 1896 there were two such retteries successfully working in Yorkshire.

In 1903 retting in warmed water was once again attempted in Ireland, in County Down, where, under the joint auspices of the Flax Supply Association and the Department of Agriculture and Technical Instruction for Ireland, a small rettery was established and kept in operation for three or four years as an experimental station. The results obtained at this small station were interpreted somewhat differently by the parties concerned. This was partly due to the fact that the arrangements for carrying out the trials left much to be desired, and partly to the prominence given to certain preconceived ideas on the question at issue.

It will serve no useful purpose to mention here all the various modifications of Schenk's original scheme and the numerous other fermentation methods in which the retting water is warmed, but a brief account of some of the more successful methods in operation at the present day is here given. The flax factories at Bruges, Courtrai, Oenkerk and Appingadam must be mentioned, all of which are turning out good fibre.

At the small factory near Courtrai, flax straw is retted in cemented tanks, each of which is fitted with a false bottom of wood beneath which steam-pipes are laid. Upon the false bottom bundles of flax straw are placed vertically so that the root ends rest upon it. Water is pumped from a small stream into a storage tank from which it flows as required into the retting tanks, entering them beneath the false bottom, until the water well covers the flax. By means of steam the water is warmed to 27°-30° C., and the water is changed two or three times during each retting operation. The straw is twice retted and otherwise treated in a manner precisely similar to that practised in Lys retting.

At the retting station at Oenkerk in Friesland, the Lys method of retting in "ballons" is successfully carried on during the warm weather in a small lake adjoining the establishment; the best straw is treated in this manner. There are also three pairs of retting tanks, built of stone and lined inside with wood, and fitted with steam-pipes and false bottoms, similar to the tanks near Courtrai. The tanks are partly sunk below the surface of the ground and measure about 12 ft. by 7 ft. and are some 7 ft. deep. Double retting is not carried on at that factory, although it is recognised as being a better practice, as the quality of the straw retted is not considered to be sufficiently high to warrant the expenditure of the additional labour necessary for double retting. The temperature of the water is maintained at about 30° C. for about 3 days and nights—until the straw is properly retted—then the water is run off into a field drain and the straw is arranged in "steeple" form on grass land to dry.

Near Bruges, there is a larger retting station than the one at Oenkerk, and here an almost identical plan is adopted, the water being kept at 27°-30° C. and retting being effected in 72 hours. The fibre produced is of good quality and colour, but, owing to the somewhat heavy initial outlay and the practice of holding over the crop of flax until the following year before retting it, only modest profits are realised.

Double retting is practised at Appingadam Central Rettery and the resultant fibre is of good quality. At this depôt the retting tanks are arranged in series or batteries of four, each measuring about 24 ft. by 10 ft. by 7 ft. deep, they are made of cement and are each provided with an inlet at the bottom for warmed water, and overflow and exit pipes which not only allow each tank to be completely emptied, but also admit of liquor being drawn from any other tank in the battery if desired. Above each battery of tanks there is a reservoir fitted with steam circulation pipes where the required quantity of water is warmed prior to entering the retting tanks.

The deseeded straw is sorted over and tied up into bundles and then packed vertically upon a false lattice floor which rests about a foot above the bottom of the tank, the straw being kept firmly in position by a lattice top and cross pieces bolted to the sides of the tank.

Generally speaking the first retting takes two days—the water being partly renewed each day—and the straw is then withdrawn and dried by "steepling" on meadow land. It is then tied up into bundles and retted a second time, being

examined at frequent intervals until the desired stage is reached. After being dried again in the field it is stored under cover until the fibre can be conveniently cleaned.

Pure Culture Methods.—Early in the 19th century, retting was studied from the biological side, and it was soon established that it was primarily a fermentation process: it was not, however, until much work had been done on this subject that any further definite knowledge was obtained. In 1868 Kolb put forward views regarding the more exact nature of the retting process, namely, that it was a pectin fermentation process whereby the insoluble intercellular substance was removed as soluble products of fermentation, thus allowing the fibre to be separated.

This explanation was warmly contested by Tieghem and others who supported the view that the process involved the resolution of the cell structure and the dissolution of the cellular membrane by a specific anærobic organism, *Bacillus amylobacter*. These and similar views were advocated until 1895, and during the intervening years retting processes were patented which were based upon the principle of adding materials to the retting bath which would encourage the growth of this bacterium.

The investigations of Fribes published in 1895 showed that the flax stems themselves carry a definite anærobic bacterium of somewhat large size, which is active towards the intercellular substance but which is quite inactive towards cellulose. This view is held at the present day, although it is sometimes suggested that there are naturally on the flax straw several species of bacteria and, according as dew retting or the various methods of water retting are carried out, so one or more of these attendant species of organisms, take prominent part. The recent researches of Störmer (1904) and of Hoffmeister (1905) show that the chief retting organism, *Plectridium pectinovorum*, is not difficult to isolate, but, as at present understood, it is doubtful whether the application of pure-culture methods of retting will be financially possible on a technical scale.

In 1899, Doumier in Lille patented a process on these lines, and it has also been tried at other places, notably at Oenkerk, where a pure culture of fermentation bacteria was introduced into the retting water at 35° C. and, provided the culture worked properly, retting was accomplished in about 48 hours, and the fibre obtained was of good quality. At present these methods of inoculation or accelerated retting are only in their experimental stage.

VIII.—SPREADING AND DRYING.

Whatever the method of retting may be which necessitates wetting the flax straw, before the fibre can be cleaned the retted straw has to be thoroughly dried. This is effected either by spreading the wet straw on suitable land or by stooking it up on end to dry.* After the wet flax bundles have stood some while on end to drain they are removed to a grass field or some such suitable place where they are opened and arranged for drying

When spreading is preferred; great care is exercised to arrange the straws evenly and regularly in rows so that gathering up when dry may be done expeditiously and with the least possible entanglement of the straws. Spreading is very unpleasant work because of the smell which comes from the wet flax and because of the dirty state the workers get into while handling the wet bundles. Conflicting views have been expressed as to how long the flax should remain spread upon the ground, but the consensus of opinion seems to favour gathering it up dry as soon as possible, there being no advantage accruing from delay, although it is considered a decided advantage to have it well washed by rain.

Instead of spreading on the ground, very often the straw is stood upon end—steepled—as has already been mentioned as being the custom in the neighbourhood of the Lys, and, indeed, wherever the best flax is prepared. A little more skill is required for this operation, but it seems to be a superior method of drying to any other.

When properly dried the flax straw is gathered together, tied in bundles and, as with all other stages of flax handling, great attention is given to making up the bundles evenly: all straws should be straight and the ends present a brush-like appearance. Great importance is attached to the manner in which the flax is put up in bundles because, if not well arranged, considerable loss may result when the fibre is cleaned. The dried straw is stored under cover of a barn or under good thatch until it is convenient to scutch and clean it during the winter months.

This matter of adequately drying steeped flax is a serious one for retting depots or central retteries where the steeping

* It has been shown to be advantageous to pass the wet straw between rollers to remove as much water as possible; this hastens drying considerably, and is a practice by no means detrimental to the fibre.

water is artificially warmed, because, were it not for the difficulty of drying the wet straw during inclement and winter weather, such depots could continue retting operations throughout the year. As it is, large areas of land have to be set apart as drying ground and they can only be used during part of the year. Various attempts have been made to dry the wet straw under cover, in a current of warmed air and in warmed rooms, but the amount of moisture which has to be removed is so great that these methods have never proved commercially successful.

To overcome these difficulties the wet straw stems have been gripped between thin wooden laths and hung up in open sheds or in artificially warmed rooms to dry, and attempts were made by Buchanan in 1853-4 to desiccate the straw while it was still in the warm water steeping tank by draining off the water and then driving unlimited quantities of dry warm air through the entire mass of straw as it stood.

IX.—BREAKING.

Before the process of cleaning the fibre is attempted the brittle, central, woody part of the dry straw is broken up into small pieces so that the fibre may receive as little damage as possible when being cleaned: this preliminary process is known as "breaking." The machines used for this purpose were formerly operated by hand and of very simple construction, consisting of grooved wooden levers or single pairs of fluted rollers between which the flax straw was passed and repassed several times. In Russia, Hungary, Silesia, and parts of Friesland, hand-breakers are still to be seen, but it may be said that these appliances have been entirely superseded wherever the flax industry has attained a fairly high level.

Although the principle of the modern machines is much the same as the old-fashioned ones, the "breaker" is now made with many (eight or ten) pairs of metal rollers, some of which are smooth to crush the straw flat, followed by many other pairs of grooved rollers differently fluted and which rotate at different speeds: the object being to break up the woody part of the stem and to remove mechanically as much of it as possible at that stage without injuring the fibre. These machines are driven by water, steam or other motive power, and ordinarily form part of the equipment of a flax cleaning mill. The straw is fed into the breaker at one end and received at the other end by lads who handle the material carefully and lay the broken straw in heaps ready for the cleaners.

X.—CLEANING.

Scutching.—As a home industry, scutching and cleaning fibre by hand or by hand-driven machinery has quite disappeared, except in Russia and some of the more rural parts of Belgium. These simple methods, which admit of varying the treatment at will to suit the particular material dealt with, have much in their favour from the point of view of preparing good fibre; they have, however, been superseded for economic reasons.

After coming from the "breaker," the broken up woody part of the straw—the "shove"—is separated from the fibre by a mechanical beating operation known as "scutching," and, save for some details of construction, this is conducted on the principle of submitting handfuls of broken straw to the beating action of wooden blades fixed to a rotating wheel. This operation, although primarily one of cleaning, also separates the individual long fibres and straightens them out uniformly.

Except where home cleaning still obtains, scutching is carried on at a suitable depôt where water power is available, or where other power is provided, so that many scutching wheels may be operated at the same time The construction of a scutch mill is such that the revolving beaters pass close in front of a rigid upright "stock" over which the flax is firmly held and submitted to rapid beating. By turning the handful judiciously and by opening out and reinserting the fibre, a skilful scutcher is able to remove practically all the "shove" by this simple means without very much waste of long fibre, whereas an inexperienced hand or a careless worker scutches most of the valuable fibre to tow without properly removing the "shove."

The ease with which flax is scutched depends largely upon whether the straw has been well or under retted. In Belgium, where flax is well retted, the scutching blades are lightly fashioned; the rotating wheel carries 12 blades and makes about one hundred revolutions per minute, whereas, in Ireland, where flax is more often under retted, a 3-foot wheel only carries six blades which are some three times as heavy as those employed in a Belgian mill, and makes upwards of two hundred revolutions per minute.

This briefly describes the operation of scutching as carried out almost universally. The methods and appliances are

primitive, and the treatment accorded the fibre is severe, yet, more recent and apparently improved devices for removing the shove (for example, parallel machines, which are so called to distinguish them from the radial beaters), have met with but slight attention from those engaged in scutching.

A large scutch mill would have about one hundred scutching stocks. Some mills are fitted with about twenty, and often, especially when water power is employed, a scutch mill has only six to eight stocks in operation. As scutching is very dusty work, it is necessary to encase the machinery and to adopt measures to keep the atmosphere of the scutch room clear by means of fans to take away the fine dust which is knocked out of the fibre. In Ireland and Belgium, many up-to-date mills have been established and are managed on co-operative principles, although there are many privately-owned mills where flax may be scutched at a fixed charge. It is considered a bad practice to scutch during very dry weather, as good fibre cannot be prepared under such conditions; consequently scutch mills are, for the most part, idle during the summer months.

XI.—OTHER METHODS OF FIBRE SEPARATION.

Steam and Hot Water.—In 1852, Watts patented a process which involved submitting the straw to the combined action of steam and hot water in specially constructed steam-tight chambers in order to separate the fibre from the straw. This method was investigated and favourably reported upon by The Belfast Flax Improvement Society, who regarded it as effecting a great saving of time and economy of fibre, whilst the usual nuisance of disposing of noxious smelling retting liquors was entirely avoided because the remaining liquid was inoffensive if not pleasant smelling.

It was, however, soon shown that the disintegration of the flax stem proceeded, not from the action of the steam *per se* but from the hot water condensed therefrom which dissolved the albuminous substances of the straw. Based upon this fact, Buchanan devised an automatic arrangement for repeatedly submitting the straw to the solvent action of hot water, kept below 82° C., at which temperature albuminous solutions coagulate.

Probably the quickest method was that made use of by M. Parsy in 1886: it consisted in heating the flax straw with

steam under pressure to 150° C. for 1½ hours, when the fibre could be easily detached.

Chemical Methods.—Of the many plans which have been tried from time to time for removing the fibre without the tedious and unpleasant process of retting, quite a large number have been based upon the use of substances such as caustic alkalies, mineral acids, phenol, oxalic acid or soap, either alone or with lime, charcoal or some other added materials, and are consequently classed as "chemical methods" of fibre separation. The first extensive user of caustic alkali for this purpose seems to have been Lady Moira (*vide* Trans. Soc. Arts, 1775), who prepared what was called "flax-cotton," and from that time dates a long list of processes of fibre separation which make use of either caustic soda or caustic potash: some methods were conducted at ordinary atmospheric pressure, whilst others required that both pressure and temperature should be above the normal.

For some reason these various chemical methods were not persevered in for any length of time. Although it is not exactly clear why they always fell into disuse there seems to be good evidence for concluding that it was owing to the dry condition of the fibre obtained, to the removal of the oily and strengthening matters from the fibre which give to it a valuable spinning quality, and also to the opposition offered by the manufacturers and the trade to the introduction of anything new. Notwithstanding serious opposition and failure in the past, there is at the present time a small factory just outside Vienna which is worked upon these lines, boiling caustic soda solutions under 15 atmospheres pressure being used to effect a separation of fibre from nettles and other fibre bearing plants, and the Austrian Government are showing considerable interest in the matter.

In London also there is a small experimental plant, demonstrating the action of a warm aqueous solution of a specially prepared soft-soap which, together with caustic alkali in the solution, is effective in separating the fibre from flax straw. The process seems to be similar to de la Reche's method and to that exploited by Lee in 1816, and although the treatment to which the fibre is subjected is not so severe as in other methods which have been tried from time to time, yet there is little "spinning" quality in the resultant fibre.

It has long been recognised that a certain portion of the oily matter of the fibre—called "nature" or "quality" by the spinner—is necessary to prevent the yarn from fraying in the

loom, as well as to facilitate spinning into yarn, and this fact is not sufficiently appreciated by those who advocate fibre separation by means of alkalies.

In 1892, Bauer patented a process for fibre separation which necessitated treating the straw with a dilute solution of sulphuric acid followed by a solution of alkali, a method which was, for a time, considered to be of some practical value, but which, like so many others, has fallen into disuse. It is unfortunate that up to the present time no real success has attended these various endeavours; it is generally found that the action of chemicals is not confined to the separation of the fibre from the woody part of the straw, but is to the detriment of the fibre required, making it weaker.

A step in the direction of preparing by chemical means a fibre possessing "spinning quality" has recently been made public by Silberrad, who, in 1911, patented a process of fibre separation which involves treating the straw with a solution containing alkali, soap and sulphoricinoleic acid at a temperature of 60°-100° C. The last-named material becomes hydrolysed during the operation, and there is deposited on the fibre a substance resembling the oily materials naturally present in the plant. The practical application of the method does not yet appear to have been made.

Mechanical Methods.—Little attention seems to have been given to methods of fibre separation which depend upon the removal of the woody part of flax straw by mechanical means only. It would seem that such a plan would be a great advance, provided the fibre obtained was in a condition suitable for spinning, because after the yarn is spun it is submitted to bleaching and other processes involving treatment with alkaline solutions which would completely remove the adhering intercellular gum. It is surprising to find that since the beginning of last century scarcely anything has been done in this direction.

In the case of hemp, purely mechanical means of separating the fibre are successful, and there is a good demand for the fibre so obtained. Some small trials with dried flax straw carried out in a laboratory two years ago rather point to this as being a line of work which would lead to success. The trials referred to were made with the object of ascertaining to what degree of fineness the woody part of the straw must be broken so that it could be completely beaten or combed from the fibre. In the following year, Mr. John Stewart, of Coleraine, made some attempts to break and scutch unretted straw, and at the present time a private company in London

is conducting trials of a process for separating flax fibre without retting the straw, but neither the details of the process nor the results are yet accessible.

XII.—COST OF PRODUCTION.

Cultivation.—It is so long since flax was grown as a field crop in this country that little importance can now be attached to the recorded cost of production. Fifteen years ago the estimated cost of this crop in Cambridgeshire, Lincolnshire and Suffolk was said to be about £5 per acre, in Yorkshire a trifle less and in the South of England a trifle more. It is probable that these figures would not represent the cost at the present day owing to the general increase in the cost of production that has taken place during the last decade. Probably £6 per acre would be a fair estimate at the present time. A more satisfactory way of expressing the cost of cultivating flax is to compare it with some other crop which is still grown. Upon this basis the cost of a flax crop is equal to about a barley crop and a half.

When the estimated cost of £6 per acre is contrasted with the average cost of production in the chief European flax-growing countries, it is seen to fall between that of Ireland and France. The average cost in all foreign countries producing the higher qualities of fibre is in excess of this estimate.

*Estimated Average Cost of producing a Flax Crop.**

Per acre.	Ireland			France.			Belgium.			Holland.			England.		
	£	s.	d.	£	s.	d	£	s.	d	£	s.	d.	£	s.	d.
Rent and taxes, etc.	1	10	0	2	10	0	2	10	0	3	0	0	1	10	0
Preparation of land ..	1	10	0	2	10	0	4	0	0	5	0	0	1	10	0
Seed	1	0	0	1	5	0	0	18	0	1	5	0	1	0	0
After-cultivation	0	12	0	1	5	0	0	17	0	2	15	0	1	0	0
Harvesting ..	1	0	0	1	0	0	1	5	0	2	5	0	1	0	0
Total ..	5	12	0	8	10	0	9	10	0	14	5	0	6	0	0

* These figures are approximate, and are only inserted here to show the relative cost in these countries.

Preparation.—Regarding the cost of separating and cleaning the fibre from flax straw, no details of a sufficiently reliable character are available which would serve a useful purpose in this report. The cost of pond retting is very variable: frequently of two districts not far removed from one another, the cost of retting in one may be double that in the other. The cost of river retting in Belgium is so largely influenced by the personal energy of the tenants of the river bank that without much more extended enquiry it is not possible to estimate the cost of this operation.

Scutching is estimated to cost about £2 10s. per acre of straw grown, but, as this depends upon the skill of the scutchers and the extent to which the straw has been retted, the cost of this operation is based upon indeterminable factors. In Ireland the usual charge for scutching is one shilling per stone of scutched flax, the scutch mill owner retaining the rug and tow which he re-scutches and sells to tow spinners.

The most reliable information would be obtained from a central rettery where proper records are kept and where the value of the product is recorded. Unfortunately, such data are not to be obtained from the few depôts in operation. The only indications of success upon which to place reliance are the general appearance of the establishments and the fact that some of them have been in operation for about 10 years, during which time modest profits have been made.

XIII.—MARKETING.

There are several ways open to the farmer for profiting by the growth of flax: (1) he may prepare his land and make it ready for sowing and then let it to another person desirous of sowing flax and taking the crop; (2) the farmer may himself carry the cultivation further and sell the standing crop just before harvest time; (3) he may harvest the crop himself and sell it entire; (4) he may prefer to retain the seed and sell the straw only; or, (5) he may carry all the operations through and finally dispose of the fibre.

Of these five different modes of marketing, circumstances generally decide which is the most advantageous to adopt. Where high rents can be obtained for "flax-land," or where there is little or no competition for the straw, the farmer minimises his risk by adopting the first course of letting his land to a

flax grower. This is largely done in Friesland and Groningen and formerly was not an uncommon practice in England where there was only one purchaser for the crop. The more general custom is to sell the standing flax crop "on foot" to a dealer who takes off the seed and resells the straw, or who prepares the fibre himself. In the more advanced flax producing countries there is a very marked tendency for the crop to be passed from hand to hand through a chain of specialists each of whom attends to one phase only of the many through which the crop passes. The third course open to the farmer, namely, disposing of the entire harvested crop, is largely adopted in France, Holland and Belgium, and is very generally advocated. It seems to be a very suitable way of disposing of the crop to a Retting Depôt where at the time of deseeding the straw the latter can be sorted and graded without additional expense. Some people advocate the desirability of the farmer retaining the seed and only parting with the straw to flax dealers, as this gives him an additional finished commodity to sell himself. The advantage of this plan is rather obscure, and certainly does not outweigh a lowering of the price of the straw due to careless deseeding on the farm, and the loss of the opportunity of sorting the straw at the time of taking off the seed. The last plan, the grower marketing the fibre, is very extensively adopted in Russia, Hungary, Austria and Ireland. As a means of providing employment within the household of small farmers during the winter months there is much in favour of this plan, but it is not a method of preparing good marketable fibre.

XIV.—ADVANTAGES ATTENDING FLAX CULTIVATION.

The subject of flax cultivation seems to present no serious difficulty—it has been grown in the past, and, with more refined methods of agriculture, there is no reason to believe that it could not be grown satisfactorily for fibre production at the present day. The greatest difficulty to be encountered will come from those farmers who, never having grown the crop before, will not touch it, or will do so with suspicion because of the somewhat unusual care and attention required from time to time if successful results are to be obtained.

Flax has been called a troublesome crop, and in view of the customary methods adopted there is justification for this name,

but when it is contrasted with other crops from an agricultural standpoint it seems to present advantages which amply compensate for its more exacting cultivation. It is sown after the main spring sowing is completed, at a time of year when labour is not so fully occupied as later on; moreover, the flax harvest comes on between hay time and the corn harvest, and consequently does not interfere with present practice. It occupies the land little more than four months, so that it may be regarded as a fallow crop. It has been shown to be a profitable practice to sow "seeds" with flax or with close farming to follow on with turnips in the same year.

Flax is a good alternative crop and for that reason alone would make a good addition to the crop rotation of this country; weather which suits flax is not good for corn, so that if cereals fail flax will probably succeed. The English seasons are not usually dry; they are rather the reverse and would favour flax.

When considered from other aspects it will be seen that the possibility of a quick cash return to the grower is in favour of the flax crop. Were the crops sold to a Retting Depôt just before corn harvest this income would be particularly welcome to farmers of small substance.

The flax industry is found to be especially favourable to small holders of land—it may be regarded as a small holder's crop rather than that of a farmer of large acreage because the necessity of weeding becomes a serious difficulty where large areas have to be dealt with. Apart from these advantages to the small farmer which arise from cultivating flax, the subsequent processes of separating and of cleaning the fibre would afford employment either for him or for members of his household during the winter months.

There is strong reason for believing that the judicious revival of the flax industry, managed according to improved methods, would be productive of benefit to British agriculture and would induce people to find regular employment in rural districts by creating a demand for skilled labour.

XV.—SUGGESTIONS AS TO FLAX CULTIVATION IN ENGLAND.

Agricultural.—The climate and soil of this country are suited to flax; it could be grown primarily as a fibre crop and at the same time the seed could be saved. The disappearance of this crop in Great Britain was due to economic reasons and

cannot be properly ascribed to defective agricultural methods, so that beyond the following observations and suggestions, little need be said regarding the actual cultivation of the crop.

Judging from information obtained in other countries the superiority of original Russian flax seed over Dutch-grown Russian seed (Dutch-Riga-Child) seems to be an open question; consequently, until reliable trials have been made in this country it is not possible to say whether one or the other would be better suited to our climate.

It is thought advisable to recommend drilling in preference to broadcast sowing, so that weeds may be removed by hoeing rather than by the more costly method of hand weeding. The flax crop is almost universally harvested by pulling it from the ground by hand. There seems, however, to be insufficient reason for adopting this method, and pending the results of practical comparative trials it is suggested that the crop be machine-cut or mown as close to the ground as possible.

If practical information were placed at the disposal of farmers there would be every reason to believe that good crops would be raised in this country. Up to harvesting the crop no difficulty need be apprehended. In some districts, notably in Lincolnshire, Cambridgeshire and Suffolk, there is a desire to return to the crop, but at present there is no sale for the straw and it does not tread well in the yard. These east central counties would be suitable districts in which to start a revival of the flax industry, but cultivation need be in no wise confined to that region, since suitable conditions obtain over a large part of the country. Near Yeovil small quantities of fibre are still prepared and disposed of locally to twine and sail makers, and it is suggested that this also would be a suitable district in which to carry out commercial experiments.

It will have been perceived from the foregoing pages that fibre separation necessitates the employment of labour more skilled and intelligent than the average farmer has at his disposal; so that, although there is much to be said in favour of the grower carrying all the operations through and himself selling the fibre, it is doubtful whether that is a practicable scheme for this country. The required specialised labour could be produced by sufficient instruction but, at best, the result would be the production of a large number of small quantities of fibre, generally of middle and low quality, varying widely among themselves according as personal and natural

factors had determined. During the course of this enquiry it has been observed repeatedly that in those countries where the farmers grow and prepare flax, generally in small quantities, there is a great want of uniformity in the quality of the fibre, and prices are low, a state of things which is scarcely to be avoided when so many variable factors contribute to the market value of the fibre. On the other hand, where some quantity of fibre, not necessarily of the best but of uniform quality, is available for the trade, it becomes a better marketable commodity. It is scarcely to be anticipated that uniformity would be attained on the lines of *finishing on the farm* in this country when it is still lacking in those countries where the flax industry has remained uninterrupted. The management of "after-processes," especially complex processes like fibre separation, does not fall properly within the province of the agriculturist and cannot be worked well into the routine of farm operations. These processes could be managed better at a Central Depôt to which farmers might send their flax crops. It will probably be found to be the best practice for both seed and straw to be sent to the Depôt rather than the straw only, but this and other details would soon be decided.

Technical.—The English flax industry existed longest in those districts where there were Central Retting Establishments to take the crop off the hands of the farmer as soon as it was harvested. There is reasonable foundation for belief that on those lines the flax industry could be successfully revived in this country. In the past, many people lost money by plunging into the complicated business of fibre separation because their financial status was insufficient to stand initial losses while experience was being gained, or to tide them over a bad period. General conditions are now more favourable, but without State aid there is little possibility of the industry being restarted, owing to the somewhat heavy outlay necessary, and more particularly to want of knowledge of the various processes.

English-grown fibre could not be expected to compete profitably with the low quality fibre imported from Russia and other countries where the labour of preparation is disregarded when reckoning the cost of production; therefore efforts should be directed to the preparation of high grades of fibre. This can be achieved by controlling the retting process and by placing the final operations in the hands of people who would specialise in fibre preparation and become expert in the handling of it.

One or more small retting dépôts might be established at suitable centres, each depôt to be capable of dealing with the produce of about one hundred acres of flax. Such establishments, managed on business lines for a few years, would enable practical information to be gained and would probably lay the foundation for further development by a company or association which could take over the business.

Regarding the purchase of flax, the best plan seems to be for the mill management to purchase the entire crop from the farmer who should undertake to deliver it at the depôt. The seed could then be economically removed by passing the top part of the straw between the butt-ends of a pair of wooden rollers fixed at such a distance apart that the seed capsules would be crushed without injury being done to the seeds they contain. This mode of deseeding threshes the seed at the same time and affords a good opportunity for sorting the straw preparatory to retting.

The method of retting should be some form of tank-retting, whereby the temperature of the water could be raised and properly regulated, a uniform product being more readily obtained when the conditions of retting can be reproduced and controlled at will. It is estimated that a battery of five tanks, providing a total area of about 1,000 square feet of water, would be sufficient to treat a crop from 100 acres during four and a half summer months; and about 4 to 5 acres of meadow land would be required as a drying ground for this quantity. The establishments should be self-contained; all the operations of sorting, retting, drying, breaking and cleaning should be conducted at the one place, sorting, retting and drying occupying the summer months, and breaking and cleaning the winter months.

Wherever good quality fibre is produced, the method of cleaning almost universally adopted is that known as the Belgian Method of Scutching. It is an operation which in the hands of skilled operators gives good results, but, in the hands of inexperienced people leads to disastrous results. There are several other methods of cleaning in which use is made of mechanical cleaning appliances requiring less specialised skill; it is probable that one of these would be better suited to the requirements of this country.

The proper equipment of such depôts would involve some considerable outlay, but there is no other way of obtaining definite knowledge as to the present financial success or otherwise of flax preparation in this country. As far as available

evidence is to be relied upon, there is a very reasonable prospect of success attending a scheme such as is outlined here.

Financial.—A flax retting depôt could not be successful unless financial arrangements were made with farmers in the neighbourhood of the depôt for them to guarantee to grow flax at an agreed price. It will probably be necessary that a guaranteed minimum price should be arranged which would be supplemented according to the quality of the crops produced. Probably some arrangement of this kind would induce careful farming, and at the same time prevent dissatisfaction among those who might grow heavy crops yielding but little fibre or fibre of poor quality and who would consequently receive small remuneration.

Apart from working capital the provision and equipment of a depôt capable of dealing with the produce of 100 acres of flax, that is to say about 200 tons of straw, is estimated to cost about £3,000; there is, however, little information which is of assistance in arriving at an estimate of this kind. One of the flax factories at present working in Holland, which deals annually with some 150 tons of straw, was established about ten years ago at a cost of £3,000, although it is now thought that a smaller sum would be sufficient.

No useful purpose would be served by attempting to give approximate prices in detail for buildings and equipment, as so much depends upon whether some already existing structure could be adapted and upon the available water supply and facilities for disposing of the tank effluent, as well as upon the kind of motive power to be employed. Much of the outlay must necessarily be for the provision of machinery, the production and distribution of steam, and the generation of about 12 h.p. by a suitable oil or gas engine. It is concluded that quite one-half of the estimated cost would thus be accounted for.

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